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from your president

Congratulations and a very warm welcome are due the newly organized Idaho State Unit of the American Society of Dentistry for Children. (For the information of the general membership of the A.S.D.C., a brand new State Unit has just been organized in Idaho.) I think this testifies to the energy, perseverance and evangelism of the dentists of Idaho to start the ball rolling in that State. As a teacher, I must take a little credit for my confreres who have begun the development of interest of their students in dentistry for children. But it takes a different kind of enthusiasm and perseverance to organize a group, especially when geography and travel may create a disadvantage. Again, our congratulations, Idaho, and we shall look forward to becoming better acquainted with you in the near future.

Plans seem to be moving along very well in the development of our program for the next annual meeting in Atlantic City. Your committee has been hard at work and the groundwork is already quite far along. Some of you may have already been approached by the committee for the enlistment of your participation. I hope you will all comply with the committee's requests to the fullest extent of your ability, for it is by such cooperation that good programs come off. We are anticipating development of the meeting with great excitement.

HENRY M. WILBUR

Psychological Aspects of Dentistry For Children with Cerebral Palsy*

JOSEPH H. KAUFFMANN, D. D. S.

ON OCTOBER 2, 1861, Dr. William John Little, the pioneer English orthopedist, first described what is now known as cerebral palsy, in a lecture before the Obstetrical Society of London. He applied the name spastic rigidity and his paper was published the following year in the Transactions of that Society. Cerebral palsy, sometimes called Little's disease, is not a pathological entity but a name given to designate a series of clinical syndromes involving various types of paralysis, incoordination, tremor and crippling effects that arise from lesions of the brain. The term cerebral palsy has been popularized by Dr. Winthrop Morgan Phelps and is prevalently accepted in public circles to indicate best those groups of disabling conditions arising before, during or after birth involving any dysfunction or alteration of normal motor activity. But children thus affected do not necessarily manifest true or complete paralysis of any part of the body.

The presence of cerebral palsy in its various forms presents a challenge to all health and social workers and to society at large. Forthright confrontation of that challenge is comparatively recent. Included in the good that can be done are those measures involving directly or indirectly the working of the mental processes of all who are afflicted and their families. The word "psychological" is heard more today than ever before. Much is written and said in the name of psychology. Some of that discussion is purely philosophical in nature and abstract in content; some of it is illuminating to the health professions and practicable in its ultimate usefulness. But no matter how philosophical or practicable such learning may be, it is a means to an end and not an end in itself. Almost all psychologists agree that there is order in human behavior. But this order varies in differing groups and the aspects of behavior in which these orders appear also differ. If the psychologist is physiologically minded, he may concern himself, for example, with the facial musculature and salivary secretion. It is in the terms of such variables that psychologists describe and predict the action of people. All people observe other people's activities in terms of everyday behavior. The psychologist's efforts are usually limited to the study of those whose behavior is abnormal or to others engaged in unusual activities or afflicted with pathological conditions. Dentists are not professional psychologists but they may learn from the knowledge and experience of those who are more adept in the science of the mind. How we give our patients the benefits of such learning and of our personal and group working observations, is a mark of our powers of adaptability. Let it be understood that we are not here discussing clinical management per se, as that is another matter to be considered separately. In the last analysis the ac-

* Presented before the Dental Guidance Council for Cerebral Palsy, New York City, November 6, 1955.

crued knowledge of the psychological aspects of dentistry for the cerebral palsied child is viable only in terms of everyday situations as they are found. That knowledge has to be applicable to the initiation, modification or elimination of the various measures pursued by the practising dentist. But the book must fit the possibilities of the child as an individual because no particular child can be unnaturally forced to fit the book. Life is that way. Psychology for psychology's sake finds little solace in the dentist's office.

Psychology deals with the mind, although what mind itself is constitutes a poignant and universal mystery. Many of the practical relationships between child and dentist, indicated by either commission or omission, depend upon causalities and processes physically invisible to us. Putting it another way, to influence the tangible seen, you must deal with the tangible unseen. For example, the reason cerebral palsied children are not found more often in the dental office is not necessarily the fault of the parent; the answer to that situation cannot be oversimplified. However, the point is that, irrespective of what the reason may be and despite any apparently insurmountable obstacles, the very fact that cerebral palsied children are seen so seldom is in itself strong basis for stimulating us to recognize how badly they must need dental care and for evoking in us an attitude of helpfulness. To be uninterested is to perpetuate a stalemate of professional expediency and human neglect. If we do not know how to work for those children we have increasing opportunity to learn. *Dentists are not licensed to do merely those things which are most convenient for them to do; they owe a moral obligation to the public to do what they ought to do.* It requires an ability at the service of a desire. One of the best places to consummate that ability and to stimulate that desire is in the undergraduate dental school where, in truth, such training is today greatly needed. There is wide room for preparatory teaching in the area not only of the cerebral palsied, but of all physically and mentally handicapped people.

In any field of treatment, dental or otherwise, the child's parents and family should be earnest cooperators. Not too much should be promised, especially for those little ones making their initial appearance in the chair. There are some cases in which very little effective service can be rendered in spite of every effort. Nevertheless, encouragement of the parents and the child constitutes psychological helpfulness as a means to an end. This point is emphasized by experienced social workers. Without doubt the sincerity of the dentist and his compassion for everyone involved are just as important as is his operating performance. It softens the blow, because no child, not even a normal one, really likes to have his or her mouth worked upon. Any form of manipulative interference with the human body is unnatural and produces either a defensive or an offensive response. At best there is always a certain apprehension even though its evidence is not visible. During the pre-school years when only the primary teeth are present, the parents of the cerebral palsied child have given him every assistance economically possible and in a way the child may be over-protected and made insufficiently self-reliant. At school age he meets more children than ever before and these other unhandicapped children tend to stimulate him to become equal to them in his capacities. Growing cerebral palsied children have more desire to associate with each other and with children of the

opposite sex. However, there are some handicapped children who shrink from those about them. The more mentally progressive type are better patients when presenting for dental care. But whatever may be the case, each child is an individual unto himself and requires personalized attention. There is no such thing as successful routinized treatment applicable to every cerebral palsied child. There may be a common denominator of basic essentials but from that point on each patient is a distinct undertaking and quite often the management of such a child, despite his best intention, is most formidable, all mollifying assertions to the contrary. It is obvious why any knowledge of the child's working mind that will aid the clinician should be welcomed.

Since motor mechanisms are usually impaired, it requires patience and understanding to get adequate response. Although the child's mentality is not necessarily subnormal, physiological activities involved in speech, taste, seeing, feeling and hearing, are diminished. The physical functions of a normal child are learned spontaneously but the cerebral palsied child requires specialized treatment and training. All this makes a difference in patient cooperation. Phelps and other workers state that about 70 to 75 percent of all cases are mentally unaffected by brain damage. The majority shows an intelligence level on a par with that of the general population. The physical limitations of the cerebral palsied child often erroneously lead one to underestimate the innate intelligence. For example, drooling and grinding do not necessarily indicate mental retardation. As a matter of fact the profoundest consideration in behalf of the cerebral palsied child is that he be recognized as a human being. Cerebral palsy represents not only motor deficiencies but sensory and mental changes also. Both professional and lay groups recognize need for total rehabilitation. Teamwork is essential. Everything that is done for the cerebral palsied child has to be integrated into his personality; the composite whole of all the good done will make him a better member of the community. As a corollary to such integration for his welfare, we should point out to him how, with such helpful services, he will be like other normal children. The most unfortunate faculty loss found in the cerebral palsied child is that of speech; there is aid for almost every other common physical dysfunction. Of course, the dentist plays an important coordinating part in the maintenance of the best possible speech faculty for the child and future adult.

As is also often the case in his relationship with normal children, it is the dentist who must get his own mind straight in the approach to actual treatment of the young cerebral palsied patient. His mental orientation in that relationship is most important and when his mind is set constructively he will be well on the way toward convincing the child that the dentist is a sincere, kind and helpful friend. The many problems involving disease and deformity that confront us daily would be met best if their causes could be eliminated; short of that ideal everything else is therapeutic and hopeful compromise. To cut down on the physical devastation present in any case is to aid the recipient of dental care to free more of his available bodily strength for improved functional activities. In doing so, his youthful energies, so frequently accompanied by a bright and even brilliant mind, may have increased opportunities to be summoned forth in behalf of a happier and healthier life.

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Diagnosis and Treatment of Gingival and Periodontal Disorders in Children with Cerebral Palsy*

EUGENE J. WEISMAN, D. D. S.†

IT IS only in recent years that our criteria in diagnosis of gingival and periodontal disease have become sufficiently accurate and precise, so that valid comparisons of their prevalence could be made among different groups of patients. In examining children with cerebral palsy one is given the clinical impression that the presence of gingival disease in these patients is generally higher than in corresponding age groups of normal children. The available literature, however, offers little information with respect to incidence and types of gingival conditions in children with cerebral palsy. Zappler[1] recognized that "inflammation and hypertrophy of the gingiva" were commonly present in patients with cerebral palsy and believed that these conditions may be ascribed to neglect of oral hygiene, to drug therapy, and to the incapability of proper mastication. Leonard[2] stated that he found a large number of cases of gingivitis in patients with cerebral palsy. He further observed "some instances of marked gum inflammation" and thought that these were occasionally attributable to vitamin C deficiencies. O'Leary reported that "Malocclusion of the dentition, unhealthy peridontal tissue, and an unclean mouth are common characteristics of the cerebral palsied". Eisenfeld and Friedman[4] also thought that poor mouth hygiene in these patients is related to "a much greater percentage of peridontal problems than is seen in normal patients."

This study will attempt to determine the incidence, and degrees of severity of gingival disease in these patients, for purposes of comparison with similar studies in corresponding age groups of normal patients.

Some Criteria for Classification of Gingival Disease

Schour and Massler[5] have devised the P-M-A index, a classification which presents a quantitative clinical method of assessing gingivitis. This method arbitrarily divides the gingiva into three components for recording purposes, but offers the advantages of rapidity and accuracy in determining incidence and severity of gingival disease. These authors designated local inflammation of the interdental papillae (P), or the free marginal gingiva of one to three teeth, as mild or slight gingivitis. The extension of the inflammatory process to form a continuous band along the gingival margins (M) of more than three teeth was considered moderate gingivitis. Clinical involvement of the attached gingiva

* Presented at the Annual Meeting of the Dental Guidance Council for Cerebral Palsy, New York City, November 6, 1955.

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(A) of the anterior and some posterior teeth with inflammation was classified as severe gingivitis.

McIntosh[6] suggested a method of assessing periodontal disease by measuring the depth and incidence of periodontal pockets. Many investigators feel that any deepened gingival sulcus of three or more millimeters in depth may be a potentially pathological area since it provides a sheltered incubation zone in which debris, organisms, and toxins can collect, and from which these destructive agents can attack the deeper tissues. This may be a significant factor in young patients, in whom accumulation of materia alba and other debris along the gingival margins is frequently seen.

Patients and Method

The patients examined in this study were in the Cerebral Palsy Dental Clinic of Columbia University School of Dental and Oral Surgery, the St. Giles Home Dental Clinic,* and the Cerebral Palsy Dental Clinic of Long Island College Hospital.† Their ages ranged from six to eighteen years. The author was assisted by Dr. Morton Shapiro,‡ in this stage of the study. The patient was seated in front of the examiner who with dental metal mouth mirror and Williams periodontal probe, made his examination of the gingiva throughout the mouth. Each examiner entered his evaluation on the P-M-A chart, and on a periodontal pocket chart.

The P-M-A charting method was used in these examinations because it provides a convenient means of recording gingival inflammation; the entire oral cavity was divided, with reference to the gingiva, into papillary, marginal, and attached components in relation to the various teeth. Each component was then graded one or zero, indicating whether or not gingival inflammation was found in the area. The completed charts present a quantitative picture of the incidence of gingivitis, and serve as a guide as to its severity.

However, in applying the above criteria to the gingiva of younger individuals, the examiner must realize that normal gingiva in children does not necessarily appear the same as normal gingiva in adults. In most children, for instance, there is normally a pinkish-red, shiny cast to the surface of the marginal gingiva, probably due to the thinner epithelial layer, a less dense hornified layer, and to the greater vascularity (as compared with the adult).[7] A transient gingivitis is commonly found around erupting teeth because of the new, heavy gingival shelf and the incidental trauma of eruption on it. On recently erupted teeth, therefore, there is often a thick roll of marginal gingiva which may remain for a period of time.

In order to define more clearly the range of normal gingivae and the degrees of gingival disease, the following standards were agreed upon by the examiners:

Normal Gingiva: Contour—the dental margin of the gums should tend to taper off to the enamel with close adherence of the free gingiva to the teeth and of the attached gingiva to the alveolar bone. When two adjacent teeth have their interproximal surfaces in direct apposition, the gingiva should completely fill the interdental space. Color—pale pink to reddish pink (depending upon the age

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group). Consistency—firm texture with no bleeding on firm digital pressure.

Papillary (mild) Disease: Appearance of swelling of the interdental papillae, with or without surface edema, usually accompanied by reddening, secondarily. Reduction or absence of stippling is usually localized to the gingival papillae which are barely rounded or blunted at their tips.

Marginal (moderate) Disease: Increased swelling with a definite reddish glazed surface, continuous along the marginal gingiva, and increase of gingival pocket depths, first proximally, later on the labial or lingual aspects of the teeth. The tissue is of spongy consistency and spontaneous hemorrhage may be present.

Attached (severe) Disease: Periodontal pocket formation (suprabony type) may be found on any or all of the tooth surfaces. The gingival tissue is usually extremely swollen, of soft texture, and reddish to dark red in color. Flattening or disappearance of the interdental papillae and suppuration in late stages may be present. The signs of inflammation indicate that inflammation has extended to the attached gingiva from the marginal gingiva. Profuse hemorrhage may occur from any part of the gingival margin, spontaneously or on light pressure.

The results of the examinations were entered on the charts prepared by the examiners. Information from the charts was transposed into table and graph form to aid in interpretation of results from the limited group of patients available for this study.

Findings

According to the data collected, as shown in Table I, 202 of the 253 (79.7%) children with cerebral palsy examined were affected by gingivitis. Twenty-one and three tenths percent of all the children examined were entirely free of gingivitis. Among 124 girls of the group, 97 or 75.8% showed signs of gingival disease. Among 129 boys of the group, 105 or 83.6%, were affected by gingivitis. In both sex groups percentages of patients with gingival disease show a sharp increase from the age of 6 to the age of 10 (from 50% to over 90%). From 10 to 12 years a level of incidence is maintained for both groups (at approximately 90% to 95%). From 12–16 years differences in incidence appear. In the male group the incidence is maintained at almost the same level; in the female group there is a sharp drop in incidence to age 14 (approximately 62%), followed by a sharp rise to age 16, to almost the same level of incidence for the male group at the same age. From ages 16 to 18, years, a difference occurs again, similar to that which occurred at ages 12 to 14.

In Table II, incidence of gingivitis in the same patients is shown according to the type of cerebral palsy; also the extent or severity of inflammation is differentiated for each type of cerebral palsy. The spastic type showed the greatest amount of gingival disease (approximately 90%), the athetoid type showed the least (67%), and the ataxic type had an intermediate incidence (approximately 83%). The "Total" column in Table II represents the final tabulation of the data from the examination and recording charts. These figures indicate that where there was gingivitis present (in 79.7%), papillary inflammation was present in 89%, marginal inflammation in about three-quarters (or 75%), and attached gingival inflammation in one-tenth (or 10%), of the patients affected.

The last column on the right in Table II contains the percentages of patients with one or more periodontal pockets

TABLE I

Incidence of gingivitis in children with cerebral palsy

Age	Sex	Number Examined	Number Affected	Per Cent Affected	Physiological Stage
6	F	25	13	52.0	First, mixed dentition or new eruption stage
	M	27	14	51.8	
		52	27	51.9 Av.	
8	F	21	17	80.9	
	M	19	17	80.0	
		40	34	80.5 Av.	
10	F	25	23	92.0	Transition stage
	M	28	27	96.4	
		53	50	94.2 Av.	
12	F	18	17	94.4	Puberty or great hormonal change stage
	M	19	18	94.7	
		37	35	94.6 Av.	
14	F	13	8	61.5	
	M	13	12	92.3	
		26	20	76.9 Av.	
16	F	13	12	92.3	Leveling off stage, mainly local factors
	M	10	9	90.0	
		23	21	91.2 Av.	
18	F	12	7	58.3	
	M	10	8	80.0	
		22	15	69.2 Av.	
Totals	F	124	97	75.8	
	M	129	105	83.6	
		253	202	79.7 Av.	

TABLE II

Types of cerebral palsy, incidence of gingivitis, and differentiation of severity

Type of Cerebral Palsy	Number of Children	Number Affected	Per Cent Affected	Extent or Severity of Inflammation			Percentage of Patients with one or more Periodontal Pockets (3 mm or more)
				Papillary	Marginal	Attached	
Spastic.....	88	80	90.9	72	60	9	96
Ataxic.....	83	69	83.2	61	49	7	90
Athetoid.....	82	53	67.0	47	40	5	84
Total.....	253	202	79.7	180	159	21	90

(of 3 mm or more in depth), in our group of patients with cerebral palsy.

The highest percentages of pockets were found in the spastic group with 96%; the next highest in the ataxic group with 90%; and the lowest percentage in the athetoid type of cerebral palsy with 84%. The average for the entire group of children with cerebral palsy who had one or more periodontal pockets was 90%.

The status of the oral hygiene of the patients examined was recorded on the chart as good, fair, or poor, according to amount of soft debris and calculus present. The results for the entire group of patients with cerebral palsy, ranged from 15% with good oral hygiene, to 45% with fair oral hygiene, and 40% with poor oral hygiene.

Discussion

It is recognized that the number of patients in this study is appreciably smaller than the number in the study used for comparison. However, it was felt that from a clinical point of view a pilot study on the limited number of patients available at this time might contribute some information of value in the problems of diagnosis, and the need for periodontal therapy in patients with cerebral palsy.

McCall[10] has stated that the foundation of periodontal disease of adult life is laid in childhood. He points out that gingivitis may often be present in children and considers it as a phase in the development of periodontitis. Schour and Massler[11] reported that 40.2% of a group of children examined in post-war Italy showed evidence of gingival disease. The same authors[12] concluded their report on Chicago school children by stating that "attached gingivitis (periodontitis) was practically non-existent in their group of children."

Stahl and Goldman[13] did a detailed study on "The Incidence of Gingivitis among a Sample of 2,160 Massachusetts School Children" and found that 28.1% showed gingival inflammation. They used the customary P-M-A system of charting, the same age groups (5 to 16 years of age), and the children examined were of approximately similar economic strata and geographical areas (coastal-metropolitan), as our smaller group of New York cerebral palsied children.

Since no investigation of this type has been done on New York school children, it was felt that Stahl and Goldman's work presented the most valid study available for comparison of average incidence of gingival disease in normal children with the incidence of gingival disease in our group of children with cerebral palsy.

In contrast to the Stahl and Goldman findings of 28.1% (average percent) incidence of gingival disease in their group, our findings of 79.7% (average percent) incidence, shows a distinct statistically significant increase. Our further findings that the boys showed significantly more gingivitis than the girls in the older age limits, agree with those of Stahl and Goldman. Where there was gingivitis (28.1% of the total group), they found papillary inflammation in about 85%, marginal inflammation in about 50%, and "attached" inflammation in about 4%. In the cerebral palsy group, we found that 89% had papillary inflammation, 79% had marginal inflammation, and 10% had "attached" inflammation of the 79.7% affected with gingivitis. It is interesting to note that our group exhibited two and one-half as much "attached" gingivitis as the Stahl and Goldman group.

Table I shows the distribution of gingival disease in the children with cerebral palsy, and illustrates a fairly definite

general pattern. It seems that, beginning at the age of 6 years, the average incidence of gingivitis arises somewhat irregularly during the period of the mixed dentition (with the eruption of the four incisor teeth and the first permanent molars) to reach a high just before the age of puberty. The slower increase in gingival disease thereafter is probably related to the slower eruption of the bicuspids (according to Schour and Massler[9] and Stahl and Goldman[13] in their studies of normals, (control groups), and to the fact that these teeth appear over a much longer period of time (approximately from 9 to 12 years of age). There is a distinct fall at the age of 14, an equivalent rise at 16 years, with a gradual tendency to level off at the 18-year-old age group. Comparison of boys and girls at different ages shows that the girls had slightly more gingival disease at 6 to 9 years of age while the boys evidenced a relatively greater amount of gingival disease from 12 to 16 years, in this study.

Stahl and Goldman reported that approximately 10% of their normal school children had poor oral hygiene. Using the same criteria, we found that 40% of our children examined showed poor oral hygiene. These figures suggest the possibility that the greater incidence of gingival disease in the group of cerebral palsied patients may be related to the increase of poor oral hygiene.

Periodontal Therapy

The treatment of periodontal disorders in patients with cerebral palsy is, as might be expected, basically similar to periodontal therapy for normal patients, with various modifications in psychological approach, suitable pre-medication,* and physical body aids and stabilizers, where necessary, according to individual need. The treatment, per se, may be divided into three phases for descriptive purposes, and any or all of these phases may be utilized:

I. Conservative therapy or removal of all local irritant factors to the gingival and other periodontal tissues. This includes complete curettage (or removal of coronal and subgingival calculus), correction or replacement of faulty restorations, contact points, marginal ridges, and elimination of abnormal or damaging oral habits. In this phase we must treat some of the special problems of cerebral palsy, such as neurological tongue-thrusting, drooling, incorrect mastication and swallowing, drug therapy, and clenching or constant grinding of the teeth with the resulting traumatic effects on the periodontal structures. We have had encouraging success with difficult cases by retraining oral musculature, special dental home care programs, and by use of plastic night-grinding splints in some patients.

II. An intensive daily dental hygiene regime including correction of diet, proper adaptation and use of the toothbrush after meals, rubber tip interdental stimulators, Stim-u-dents, water rinses and sprays (such as Oro-jet) for both cleansing the teeth and providing the much needed gingival massage. This phase is always included as an integral part of, and often precedes, in order of importance, the other phases of periodontal treatment. The oral hygeine part of the periodontal program cannot be overemphasized to both the patient and the parent. In severely physically handicapped patients, it is often the parent or attendant nurse who does the more difficult of the dental home care procedures, and the instructions are directed accordingly. It is desirable however, that the

* Further research in this area is now in progress at Columbia University by Dr. Solomon Snyder and at Long Island College Hospital by the author.

patient, no matter how handicapped, at least start the toothbrushing for himself or herself, and be shown the satisfying results of a clean mouth and improved smile. This is invaluable, from a psychological standpoint, in encouraging personal interest and pride in care of the mouth on the part of the patient. The dental home care regime should always be kept foremost in the mind of the child with cerebral palsy, because it is only in this way that we can practice preventive periodontics and avoid the unnecessary loss of teeth in later years when oral esthetics and function are so much more important in contributing to the psychological attitude of the handicapped person.

III. Surgical therapy or removal of the remaining periodontal pockets and recontouring of the periodontal tissues to create a more favorable local oral environment. Where the periodontal tissues have not responded sufficiently to conservative therapy and proper home care, the various periodontal-surgical approaches must be considered. It may be necessary to use gingivectomy, gingivoplasty, or osteoplasty procedures to remove the diseased gingival tissues and restore the periodontal structures to normal function and health.

Summary and Conclusions

1. Using the P-M-A charting system, 253 children with cerebral palsy (from the New York area) were examined and 79.7% exhibited gingival inflammation.

2. The incidence of gingival disease in the group of New York children with cerebral palsy is almost three times the incidence in a control group of normal Massachusetts school children, of similar age range.

3. The incidence of "attached" gingivitis in our group of children with cerebral palsy is two and one-half times as high as it is in the group of normal school children.

4. In both this study and the Massachusetts study, the older boys showed a significant increase in gingivitis over older girls.

5. In the group of children with cerebral palsy, 90% of the cases had one or more periodontal pockets (three mm. or more in depth).

6. In the cerebral palsy group 40% of the children had poor oral hygeine, compared with 10% in the normal group; this marked increase in poor oral hygiene may be associated with the greater incidence of gingival disease in the cerebral palsy group.

7. From the above findings it would seem that both preventive and therapeutic periodontal care are urgent for these patients. We may also conclude, from this investigation, that a complete program for prevention of these gum disorders, and specialized periodontal treatment where necessary, should be an integral part of any total dental habilitation program for patients with cerebral palsy.

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Notices

The next examination to be given by the American Board of Pedodontics will be held at the College of Physicians and Surgeons, School of Dentistry, San Francisco, California, July 25–27, 1957.

Ralph L. Ireland, D.D.S., *Secretary*
School of Dentistry
Lincoln 8, Nebraska

Deadline dates for material to be published in our Journal in 1956 are as follows: 2nd Q April 1, 3rd Q June 1, 4th Q October 1.

Unit News should be sent to Mel Noonan, 630 N. Woodward, Birmingham, Michigan at least two weeks prior to the above dates.

The Diagnosis of Disorders of Occlusion in Children with Cerebral Palsy*

SEYMOUR KOSTER, B. A., D. D. S.†

NO OTHER problem in the dental field today is more in need of scientific study than that of cerebral palsy. This neuromuscular disorder, which may be present, or may occur, at birth and persists throughout the life of the patient, is one of the most serious causes of crippling children. In its wake are many distortions of habit and structure which result in severe oral conditions.

Cerebral palsy is a term used to designate any paralysis, weakness, incoordination or functional aberration of the motor system resulting from brain pathology. Four clinical types of cerebral palsy are recognized: 1. Spastic; 2. Athetoid; 3. Ataxic; 4. Mixed.

The spastic type is marked by stiffness, and results from a lesion of the cortical layer of the brain which normally controls voluntary, planned movements. The athetoid type is marked by involuntary motions, and is due to a lesion of the basal ganglia. The tissues involved normally control automatic and associated movements of posture. The ataxic type is characterized by loss of equilibrium and muscle interaction, and is due to a lesion of the cerebellum.

Clinical evaluation is difficult due to the large number of "mixed" types of cerebral palsy. There are those patients which show clinical signs of spasticity with some athetosis and/or ataxia. Many clinical records show that at an early age a child was diagnosed as spastic and two to three years later this same patient was called athetotic or of the mixed type.

The cerebral palsy dental patient often will present a variety of difficulties to the practitioner and, unless the nature of these difficulties is understood and intelligently overcome, it is more than likely that the quality of dental treatment will suffer. The author believes that a basic knowledge of neuroanatomy and biologic principles are necessary in the treatment of cerebral palsy patients. When these patients present themselves to us we should have some understanding: (1) of the type of cerebral palsy involvement, (2) how this type of neuromotor deficiency affects body function, and (3) the approximate location of the brain lesion. It is only after we have this clinical picture of our cerebral palsy patient that we can approach him with a basic philosophy towards treatment.

In the diagnosis of cerebral palsy orthodontic patients, it is necessary, before instituting any type of therapy, to examine the patient for: (1) intra-oral and extra-oral neuromuscular deficiencies, (2) tonic condition of the muscles associated with the oral cavity, and (3) intra-oral forces, as tongue thrust, mouth breathing, bruxism and tissue biting. (See Diagnostic Chart, Table I.) We then try to determine how the intra-oral forces and the tonic

* Presented before the Dental Guidance Council for Cerebral Palsy, New York City, November 6, 1955.

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TABLE I

Extra-oral and Intra-oral clinical signs to aid in diagnosis of cerebral palsy dental patient (with head and neck involvement)

Spastic	Athetoid	Ataxic
Limited head movement	Excessive head movement	Slow, tremor - like head movements
Hypertonicity of facial muscles. May be unilateral (hemiplegia) or bilateral (quadriplegia)	Bull type neck	Hypotonic orbicularis oris muscle
	Lack of head balance	Slow jaw movements
	Head is drawn back	Speech involvement
Slow jaw movements	Quick jaw movements	Visual organs may be involved (nystagmus)
Hypertonic orbicularis oris muscle	Hypotonic orbicularis oris muscle	Varied types of malocclusion
Mouth breathing (75%)	Grimacing, Drooling } 85% of cases	
Spastic tongue thrust	Mouth breathing (continuous)	
Cl. II Div. II malocclusion 75% (usually with unilateral cross-bite)	Tissue biting	
	Tongue protrudes between teeth and lips	
Speech involvement	High and narrow palatal vault	
Constricted mandibular and maxillary arches.	Cl. II Div. I malocclusion (90%) (usually with anterior open-bite)	
	Speech involvement	
	Muscles of deglutition usually involved	
	Bruxism	
	Auditory organs may be involved	

condition of the musculature have contributed to the present malocclusion.

After obtaining a medical and dental history, and good laboratory records, we then decide upon our course of therapy. The type of therapy will depend upon the extent of the neuromuscular involvement in and around the oral cavity and the appliance which is most favored by the orthodontist. It is not the intention of this essay to discuss appliance therapy but to bring forth the salient factors in the orthodiagnosis of these handicapped children.

Cerebral palsy patients show a high incidence of malocclusion. The athetoid group has the greatest percentage of malocclusions, which are predominantly of the Class II Division I type with anterior open bite. The spastic group has the next greatest percentage of malocclusions, usually of the Class II Division II type with unilateral cross-bite. The ataxic group has varied types of malocclusions.

Through intensive clinical examination, and medical and dental histories studied in the Cerebral Palsy Dental Clinic at Columbia University, School of Dental and Oral Surgery, it was concluded that the high incidence of malocclusion in the cerebral palsy patient is due to three main factors:

1. Abnormal tonic condition of the facial and cervical musculature;
2. Involuntary, pernicious intra-oral functioning;
3. Abnormal mastication and deglutition.

The intra-oral forces, such as mouth breathing, tongue thrust, tissue biting and bruxism are not to be considered as habits in these children but are rather a part of the cerebral palsy syndrome.

In the moderately to severely involved patient, we are confronted with a child who cannot hold his head up and cannot sit up. Both head and trunk may fall forward, sideways or backwards. The child

may be able to raise his head but hold it erect only momentarily. His mouth usually hangs open and the tongue is thrust forward between the lips. In the athetoid patient the muscles of deglutition are almost always involved, causing saliva to collect in the floor of the mouth. As the tongue is thrust forward it will push the saliva anteriorly and out of the mouth; the result is drooling. Bruxism is quite common in the athetotic child, especially when he grimaces. He will usually grind his teeth during the waking hours and very little when he is asleep. The anterior open bite is quite common in both the spastic and athetoid patients, due to the spastic tongue thrust and protrusion of the tongue between the teeth. In the spastic hemiplegic patient there is a unilateral cross-bite in one of the buccal segments. The cross-bite is usually found in the spastically involved side, due to the lateral pull of the hypertonic muscles on the mandible. The spastic hemiplegic and quadriplegic patients will usually show facial asymmetries and the dental midline is displaced. We assume that the procumbent relationship of the labial segments are largely due to to the neuromuscular deficiencies in the athetoid group of patients. The hypotonic condition of the muscles associated with the oral cavity (orbicularis oris, buccinators, etc.) offers no resistance to the intra-oral pressures upon the dentition. In the spastic group the maxillary and mandibular arches are constricted and show a pronounced curve of Spee.

The cerebral palsy patient with a malocclusion may be treated successfully. Therapy is not only a matter of tooth repositioning but also includes the treatment of a motor disability. Therefore, our treatment will rest upon three basic principles: (1) attainment of muscular relaxation, which should then be followed by (2) voluntary muscular control, and we then train the patient for the (3) development of proper movement patterns. These patients should be taught to swallow, suck and chew correctly by exercising the lips, tongue and jaws. Only after successful muscular training and development will we have successful retention in our completed orthodontic cases.

This myofunctional therapy can be successful and gratifying if applied in conjunction with speech therapy and physiotherapy. Team participation is extremely important and necessary in the treatment of these handicapped children.

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Relative Solubility of the Intact Enamel Surfaces of Primary and Permanent Teeth

EARL R. LEY,* MARJORIE L. SWARTZ† AND RALPH W. PHILLIPS‡

MUCH research has been devoted to enamel solubility and the many factors which may influence it. The composition of enamel from primary teeth has been compared to that of permanent teeth.[1-3] However, only two reports have investigated their comparative rates of dissolution in organic acids. Volker[4] determined the weight loss of powdered samples of enamel from both primary and permanent teeth, subjected to an acid decalcifying solution. By this test the enamel from primary teeth proved to be slightly more soluble than did enamel from permanent teeth. Mizuma,[5] employing small chips of enamel, found samples of enamel from primary teeth to be considerably more soluble than those of enamel from permanent teeth. No work has been done, however, to measure the relative rates of dissolution of the outer layer of intact enamel from primary and permanent teeth. Hence this study was undertaken to determine quantitatively the amounts of calcium dissolved by acid from these intact surfaces.

PROCEDURE

Twenty-two sound primary teeth and 22 sound permanent teeth, placed in tap water immediately on extraction, were carefully selected for use in this experiment. The origin of the teeth was unknown and no attempt was made to determine a relationship of solubility and water fluoridation.

The test procedure employed was that of a window type test which has been utilized in other investigations for measuring the solubility of intact surfaces.[6-10] The exact technique for the placement of the windows in this investigation has been described.[9]

An area of enamel, 2.0 mm. in diameter, was exposed for a period of 40 minutes to 10 ml. of a pH 2.5 acetic acid solution. The teeth were mechanically agitated in the solution throughout this exposure time. On removal from the decalcifying solution they were rinsed with a stream of distilled water and the solutions diluted to 25 ml. Five ml. aliquots were taken for calcium analysis. All analyses were done in triplicate by the method of Solomon, Gabrio and Smith[11] with slight modification.

RESULTS

The amounts of calcium dissolved from intact enamel surfaces of primary and permanent teeth appear in table 1. As has been observed in previous research studies,[7-9] the solubility of individual tooth surfaces varies markedly and seems to emphasize again the necessity of employing a large number of specimens when utilizing this type test. The standard deviation was comparable for both types of enamel.

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TABLE 1

Mg. % Ca

Permanent	Primary
0.737	0.750
0.725	0.774
0.530	0.633
0.728	0.785
0.670	0.723
0.669	0.955
0.794	0.633
0.610	0.727
0.703	0.518
0.661	0.677
0.555	0.556
0.739	0.731
0.465	0.763
0.453	0.884
0.564	0.777
0.582	0.718
0.669	0.640
0.808	0.635
0.676	0.791
0.325	0.631
0.585	0.535
0.672	0.536
Mean = 0.633	Mean = 0.699
St. dev. = ±0.116	St. dev. = ±0.110
% Diff. = 10.4	

The difference of 10.4 per cent in the average solubility of the intact surface of primary and permanent enamel is comparable to the difference in the solubility of powdered samples as found by Volker.[4] It is not nearly so great, however, as the differences obtained by Mizuma.[5] The authors are cognizant of the fact that although studies on the solubility of intact surfaces undoubtedly offer more clinical application, the test is generally not as delicate for demonstrating small differences as one employing powdered enamel. Previous experience with this test has indicated it to be an excellent one for determining appreciable differences in solubility. However, even with meticulous selection of teeth and subsequent polishing to reduce irregularities, slight variations in surface areas are unavoidable. Thus the actual significance of this difference of 10.4 per cent found here is to be questioned.

Summary

The rates of calcium solubility of the intact surface of enamel from primary and permanent teeth in acetic acid have been compared. Although the average solubility of the primary tooth enamel was 10.4 per cent higher, it is not felt that the difference is significant. The exact relationship existing between small differences in enamel solubility and caries incidence is unknown and since there is considerable variation in the solubility of the intact surface of individual teeth, it is the opinion of the authors that this small difference noted could not account for variations in caries incidence in the primary or permanent tooth. Susceptibility to caries would have to be attributed to factors other than differences in the resistance of the enamel to acid.

The authors wish to acknowledge the co-operation of Drs. Ralph E. McDonald and Arthur Klein.

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Treatment of the Vital Exposed Primary and Young Permanent Teeth

CHARLES A. SWEET, JR., B. S., D. D. S.*

INTRODUCTION

THE management of the pulp in children is one of the most important phases of Pedodontics. Dentistry has advanced tremendously in the last ten years, and we now realize the importance of a sound healthy dentition. It is imperative that the child's dental integrity be kept intact for the preservation of space, function the elimination of infection, and desirable esthetics.

Unfortunately, many times when we first see the child, carious exposures are present. Therefore, a complete understanding of pulp therapy is a necessity in doing dentistry for children.

PRIMARY DENTITION

A roentgenogram is always necessary. Both the bitewing and periapical views are a prerequisite in correctly diagnosing the case, as well as a thorough clinical examination. All vital exposed primary teeth may be successfully treated *unless* any of the following conditions are present:

A. If the root or roots are more than two-thirds resorbed.
B. A history of unprovoked tooth aches.
C. A sensitivity to percussion.
D. Abnormal mobility of the tooth.
E. Odor or presence of suppuration.
F. Periapical or bifurcation alveolar involvement.

Successful pulp therapy in the primary dentition depends upon four main rules, which are:

1. The pulp in the canals must be vital.
2. The field of operation must be kept free from contamination and dry at all times.
3. The tooth must be opened sufficiently wide so that you may readily see into all portions of the pulp chamber.
4. The use of medicaments of sufficient strength to destroy all forms of bacteria.

In anesthetizing the primary tooth, always use a topical anesthetic and wait a sufficient length of time for it to act to its full potential. A twenty-seven gauge syringe needle is preferred. In the lower arch, a mandibular block injection is indicated. In the upper arch, either an infra-orbital or a sub-periosteal injection will give the desired results. Injection into the pulp or pressure anesthesia is inadvisable.

This paper is not intended as one on patient management, however, it is imperative that you have deep profound pulpal anesthesia, for if the child is hurt, it will result in a management problem. This can be circumvented by being sure of your technique, or augmenting your anesthesia, if the operator is insecure, by sedation. One rule to follow is—never thrust the needle through the tissue, but always bring the tissue over the needle.

THERAPEUTIC PULPOTOMY—PRIMARY DENTITION

In the primary dentition, we utilize the Therapeutic Pulpotomy, the tech-

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nique for which is as follows: As soon as the anesthetic has taken effect, isolate the primary tooth with either a rubber dam or cotton rolls, with or without a saliva ejector. In the rubber dam application on the primary dentition, rubber dam clamps to use are the following:

S.S.White No. 1A. Lower second primary molar.

S.S.White No. 2A. Lower right second primary molar.

S.S.White No. 3A. Upper left second primary molar.

S.S.White No. 4A. Upper right second primary molar.

S.S.White No. 5A. Mandibular and maxillary left partially erupted first permanent molars.

S.S.White No. 6A. Mandibular and maxillary right partially erupted first permanent molars.

Use a 5″ x 5″ rubber dam, using the smallest hole on the rubber dam punch for the primary cuspid, the second hole for the primary first molar, the third hole for the primary second molar, and the fourth hole for the first permanent molar. If the primary tooth is badly broken down, just construct a close adapting band.

Wash the field of operation with 70% alcohol and dry with warm air. With a No. 701 or 557 fissure burr in the contra-angle, prepare the cavity. A common error is to scoop out the decay first, which will lead only to pulpal contamination. Prepare the cavity so that when you go into the pulp, you will readily see into all portions of the pulp chamber.

When the cavity preparation is complete, remove the caries with a sharp spoon excavator. After the tooth has been cleaned of caries, the top of the pulp chamber is removed with a clean fissure burr. The pulp chamber contents are removed with either medium-sized sharp spoon excavators or a No. 6 round burr running contra-clockwise. All of the bulbous portion of the pulp is removed. The hemorrhage is controlled, and the pulp chamber cleaned with the solution from the procaine solution placed upon a cotton pledget. In a primary tooth, be sure to run the burr contra-clockwise so you will not disturb or remove the filaments from the canal or canals. After the pulp chamber is thoroughly dried, a dressing of Cresolated Formaldehyde, or Camphorated Para-Mono-Chloro Phenol on a cotton pellet is placed in the pulp chamber and sealed with zinc oxide and eugenol for a period of three to five days. Be sure to take up the excess medicaments on a dry cotton roll before placing the cotton pledget into the pulp chamber. If this is done, there will be no post-operative pain. Pain is due to the fact that too much medicament is placed into the pulp, and a medicinal hyperemia results.

At the second appointment, no local anesthetic is needed. The tooth again is isolated, washed with 70% alcohol, dried, and the zinc oxide and eugenol dressing is removed. Any stain or bloody exudate is removed with a sharp spoon excavator or hydrogen peroxide. A dressing of Beechwood Creosote is sealed into the tooth with temporary cement for three to five days.

At the third appointment, isolate the tooth, wash with 70% alcohol and dry. Remove the temporary cement and Beechwood Creosote. The pulp chamber is filled with a thick creamy paste of zinc oxide, eugenol and Creosote Formaldehyde, which has been prepared by mixing on a slab using equal parts of Creosolated Formaldehyde and eugenol. With an explorer, place this paste on the sub-pulpal wall. Using a large sterile pellet of cot-

ton, the paste may be pressed over the filaments in the pulp canal or canals, leaving a layer of one to two millimeters of the paste covering the sub-pulpal wall. The remaining portion of the pulp chamber is filled with crown and bridge cement, allowing sufficient cavity space for the tooth to be restored with silver amalgam.

It is anticipated that certain conditions will arise so that the full three treatments cannot be carried out. In those cases, after the pulp has been removed and the chamber thoroughly dried, the canal is washed with a Thymol Phenol solution. Dry and place zinc oxide, eugenol, and Creosolated Formaldehyde paste, cement, and then an amalgam restoration all in one appointment. This technique should not be followed unless an emergency arises, as you can anticipate approximately 22% failures.

With an accurate diagnosis and carefully followed treatment plan, which will eliminate contamination, this technique has proven more successful than all other methods investigated and tested, as far as clinical, physical and radiographic examination can reveal. Histological studies are under way, and the results are so far very gratifying.

In the primary dentition, we have been very unsuccessful in utilizing the calcium hydroxide technique. After a two year period, our failures range over 65%. The reason for this is that the pulp of a primary tooth is much more cellular and contains both odontoblasts and odontoclasts. The calcium hydroxide stimulates both of these cells in production and action. This odontoclastic action causes an extremely high percentage of internal root resorption. Calcium hydroxide should be utilized on the permanent dentition where the pulp is less cellular, and where the odontoclastic action is at a minimum.

Vital Pulpotomy—The Permanent Dentition

In the permanent dentition, always utilize a calcium hydroxide technique. Local anesthesia is administered. To get deep, profound pulpal anesthesia on the upper first permanent molar, you use the tuberosity injection, plus the subperiostal injection over the mesial buccal root.

After your anesthesia has taken effect, isolate with the rubber dam. Wash off with 70% alcohol, then with a medium-size taper fissure burr in the contra-angle, prepare the cavity. After the outline form of the cavity preparation is completed, remove all of the caries with the exception of that last bit of decay covering the exposure. After the tooth is thoroughly cleaned, remove the last bit of caries, and then with a clean fissure burr, remove the top of the pulp chamber. Remove the bulbous portion of the pulp with a medium-size long spoon excavator. Hemorrhage is controlled with sterile cotton pellets and procaine solution, or you may use aqueous epinephrine. A thick mix of calcium hydroxide and sterile distilled water, at least one millimeter in thickness, is placed over the filaments. The calcium hydroxide paste is covered with a thin layer of cavity varnish, zinc oxide and eugenol, or wax. Crown and bridge cement is flowed into the pulp chamber, covering the separating media to the desired level.

It is advisable to complete the cavity preparation after placing the cement base. A gold inlay restoration onlaying the cusp tips is the restoration of choice. No cavity preparation should be attempted after this appointment until you can demonstrate radiographically the presence of secondary dentin over

the filaments. This will take a minimum of six weeks. Many failures are caused by having the patient come in a week or so later and preparing the cavity. The heat which is generated prevents the undifferentiated mesenchymal cells from differentiating into odontoblasts, which will result in failure.

If the operator does not contemplate finishing the preparation at the first appointment, then the whole cavity should be filled with cement until pulp healing occurs.

At this point, it is important that we understand the difference between a young permanent tooth and an adult permanent tooth. With age, there is a decrease in the cellular component and increase in the fibrous elements. This equips the young permanent tooth with the ability to provide many cells for its defense. It allows the undifferentiated cells to differentiate themselves into whatever type of cell is needed. An alkaline substance, such as calcium hydroxide, is capable, when coming in contact with these cellular elements, of initiating a differentiation of the mesenchymal cells into new odontoblasts, which prompt the formation of new dentin, bridging over the gap that occurred over the pulp exposure. In an adult tooth, one should never attempt a pulp capping or a pulpotomy, as the cellular elements at the constricted filaments and slight exposures are too few in number. With the adult permanent tooth, we would suggest a partial bulbous pulpotomy so that calcium hydroxide will come into contact with as much pulp tissue, and at the same time as much cellular structure as possible, thereby raising the percentage of success.

Conclusion

It is imperative that we maintain a healthy mouth for the elimination of infection, proper function, phonetics, esthetics, and the preservation of space. A thorough understanding of the pulp and its reactions is essential. The preservation of the primary tooth and the young permanent tooth in a healthy condition will help to prevent crippling of the adult dentition.

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Unit News

Iowa

On February 22, 1956, the Children's Dentistry Study Group composed of members of the Iowa Unit met in Iowa City and discussed "Space Maintenance for Children."

On April 2, 1956, Dr. Ralph Ireland was the guest speaker at the meeting held in Des Moines. Reporter W. G. Goodale proclaims both meetings were a success.

Rhode Island

Dr. Roger H. Brown reports the membership has increased and there is a definite interest being shown for pedodontics by the recent graduates. He also forwarded the following program. Local pediatricians were invited as guests for the March meeting.

Monday, February 20—Movie Night: *Johnson's Hummocks*

The following sound films were shown and discussed.

1. T. V. Dental Clinic (1955) on primary teech.
2. The Child and His Thumb—orthodontic, pediatric, and psychological viewpoints.
3. Operative Hypnodontics—provocative.
4. General Anesthesia for Operative Dentistry in Children.

Monday, March 19—Handling the "Unmanageable" Child.

Clinician: Eric Denhoff, M. D. Chairman, Mentally and Physically Handicapped Committee, American Academy of Pediatrics.

Also the film "The Retarded Child."

Monday, April 16—Fractures of Anterior Teeth.

Discussion of the care and treatment from traumatic injury to the final permanent restoration.

Clinician: Dr. Paul Sydow, Pedodontist from Framingham, Mass.

May—Annual Meeting.

All Day Teaching Clinics at Samuels Clinic. Assisted by the Pedodontic Department of Georgetown University Dental School. Evening Banquet, Election of Officers, Prominent Speaker on Pedodontics.

Dr. A. Budner Lewis
Chairman
Program and Educational Committee

Oklahoma

Editor John E. Lewis relays the message that the Oklahoma Unit is still going strong and they supported the state "Smile of the Year" Contest. The contestants are at the junior high age level and are judged on a dental and personality standpoint. This contest stimulates very fine public relations.

At the state meeting in April, the Unit participated in table clinics and on panel discussions.

Kentucky

The first fall meeting of the Kentucky Society of Dentistry for Children was held at the Hotel Henry Watterson in Louisville, on November 13th and 14th, 1955. A post-graduate course on Pedodontics was presented by Dr. Ralph McDonald of

Indianapolis, Indiana, Chairman of the Department of Pedodontics at Indiana University School of Dentistry, Dental Director of James Whitcomb Riley Hospital for Crippled Children, and member of the American Board of Pedodontics.

Dr. McDonald's presentation was interesting and very informative. His material was practical, from the viewpoint of the private practitioner, as well as current and educational. Many members felt that this type of meeting would be very beneficial to dental students, and the possibility of a junior membership to enable their attendance was discussed.

Twenty-one members of the Kentucky Unit were enrolled for the course.

EDWARD B. GERNERT, D.M.D.,
Secretary-Treasurer, K.S.D.C.

NEBRASKA

The first news received from Nebraska for quite some time was sent by E. G. Wilkinson and reported the successful meeting which was held at the Hotel Yancey in Grand Island on April 2.

Dr. Faustin H. Weber of Memphis, Tennessee, gave a one-day course on "Effective and Economically Sound Preventive Orthodontics."

The hosts in Grand Island had special activities planned for the wives and assistants.

MICHIGAN

Under the leadership of President Hugh Kopel and program chairman Haig Garabedian, the Michigan Unit had a series of programs which were considered a post graduate course for the general practitioner. The series of programs covered subjects of diagnosis, patient education, operative procedures, local anesthesia, anomalies, preventive orthodontics, radiology. If success is measured by attendance, these programs had no failures.

Book Review

ADAMS, C. P. *The Design and Construction of Removable Orthodontic Appliances.* Bristol, England. John Wright and Sons, Ltd. 1955. 96 p. 144 illustrations

This book is an excellent teaching manual in introducing a phase of dental care to the practitioner who would be interested in developing his own skill with removable orthodontic appliances. The illustrations are excellent and the text is informative and concise. Those who are familiar with the complexity of the Schwarz arrowhead type of clasp for retention will welcome an ingenious modification which is completely described here. It permits use of individual tooth retention instead of complete reliance upon the retention area of the interproximal space.

Dr. Adams is as careful to point out the limitations of these types of appliances as he is to describe their versatility. Indeed, for all the seeming simplicity of presentation, there is presented a fund of knowledge which makes the text as valuable to the experienced orthodontist as it will be to those less trained in that specialty.

Every practical auxiliary and modification of the removable orthodontic appliance is adequately described and illustrated. A manual of this type is to be praised in augmenting care for many cases which might otherwise be neglected by lack of a reasonable procedure and technic.

MARVIN DAVIS

Psychological Adjustment of the Family to the Handicapped Child*

VERNON S. TRACHT†

IT IS a pleasure as well as a privilege to have this opportunity of addressing an organization whose members are vitally interested in the oral rehabilitation of physically and mentally handicapped persons. Needless to say, I am in hearty agreement with your aims and purposes as set forth in the program folder. There is no question in the minds of those of us working in clinics and rehabilitation centers about the great need for dentists to be included in the team approach to the challenging problems presented by handicapped people. It is most encouraging that meetings of this type are held, whereby we in various specialties can come together for lectures and general discussion—all of which will lead to a greater understanding of and better care for those who are afflicted.

Because my own field of specialization is largely that of cerebral palsy, I trust that you will bear with me if I stress primarily the psychological aspects of this neuromuscular disability. As you may know, there have been a number of articles and pamphlets already published concerning dentistry as applied to the cerebral palsied. In one of them[5] the author states that successful treatment depends upon the following three factors, among others:

(a) The patient's physical potentiality to perform the motor tasks necessary in any program of dental care, e.g. opening the mouth, controlling the tongue, chewing food, brushing teeth, etc.

(b) The patient's mental potentiality and willingness to perform to the best of his ability what is necessary, and his cooperation in the dental chair.

(c) The skill and understanding of the dental personnel administering and guiding the care.

Obviously, the second and third are the most important from the psychological standpoint, and I will discuss these shortly. But even the first has a psychological component which can be easily related to the second and third factors—namely, the patient's physical capacity to perform motor tasks is strongly influenced by his mental status: his degree of understanding and his willingness to cooperate, and likewise by the psychological sensitivity of the dental personnel themselves. Thus, there is a certain amount of inter-relationship between all three factors in terms of my topic.

Returning for a moment to the pamphlets on dental care and the cerebral palsied which I mentioned, I found them somewhat ambiguous and confused as regards the question of the mental ability of such persons. However, they merely reflect the general uncertainty that has characterized our growing knowledge of the subject. To illustrate, let me quote a

* Presented at the Third Annual Convention of the Academy for Oral Rehabilitation of Handicapped Persons, February 5, 1956, Chicago, Ill.

† Senior Psychologist, Children's Rehabilitation Center, Mercy Hospital, Chicago, Illinois.

few statements taken at random from several of these sources. One[4] states:

> Many . . . erroneously believe that work with the cerebral palsied is always work with mentally subnormal children. Nothing could be further from the truth. That some . . . have been educationally retarded is true and naturally so. . . . Mentally they are usually normal, sometimes abnormal, occasionally subnormal. . . . In short, one is not dealing with cases of feeble-mindedness.

Another[3] says:

> The affliction may involve the child's motor, sensory or mental powers. These children although crippled in numerous ways bodily, are not necessarily feeble-minded.

And still another[2] comments that:

> Mentality is normal, if the thinking areas of the brain are not injured.

As you may gather, each of these authors' statements contains at least a measure of truth about the matter. And one thing is certain: we have come a long way in our research studies and findings from the time in 1862 when Dr. William Little, the noted English surgeon, first described the condition now known as cerebral palsy. In his monograph he gave the inaccurate impression that *all* children with this disability were mentally deficient. We definitely know that impaired intelligence does not necessarily accompany the motor involvement. On the other hand, our optimism of a few years and more ago, fostered by early research estimates of Phelps and McIntyre, to the effect that two-thirds to three-fourths of the cerebral palsied population had so-called normal intelligence, has not been justified on the basis of more recent and more exhaustive research findings.

According to the very latest book on the subject, co-edited by Cruickshank and Raus and containing contributions of leading specialists in all phases of the field, a compilation of seven separate studies on the subject of intelligence, covering 3037 children, revealed approximately 50% as falling in the mentally defective range below 70 I.Q. It should be emphasized that these were "independent studies involving different population groups, competent psychological researchers, identical instruments, and for the most part similar decisions regarding test adaptation"[1]. And yet their results are in surprising agreement.

My own research findings, published in the January–February, 1955 issue of the *Cerebral Palsy Review* and entitled "A Suggested System of Classifying Children with Cerebral Palsy," are in substantial agreement with these extensive results. However, mine included only 224 children and the percentage of defective children was somewhat higher —63% below 70 I.Q. and 37% above 70 I.Q. This higher figure is probably due to the fact that certain selective factors tend to be operating in a clinic setting, wherein the more severely involved children are quite likely to outnumber the lesser involved.

Thus, in summarizing this problem of mental status, we can well afford to be much more optimistic than was the case when Little wrote his monograph nearly 95 years ago, yet we must be somewhat less optimistic—or, perhaps I should say, more realistic—than we were only a few years ago. We must, in my opinion, face squarely the problem of a larger proportion of mentally retarded children among the cerebral palsied population as a whole. That is to say, we must be prepared to deal with more children whose learning difficulties are serious enough to cause them to be classified as mentally defec-

tive. Furthermore, I believe it is quite possible for us to adjust our remedial efforts and ultimate goals so as to better meet the needs of these more numerous retarded CP children—not to mention their perplexed and very anxious parents —for a reasonably happier, fuller life.

The point I wish to make in this brief discussion of mental ability is that, from the standpoint of your dental profession, you may be called upon to treat children (and even adults, of course) who vary from one extreme to the other, both in degree of motor involvement as well as in mental function. Consequently, you must expect that some will not be able to understand and to reason as readily as others of the same chronological age; also some, because of wider, richer experience and the ability to profit from it, will be amenable to constructive suggestions and will be more comfortable and cooperative in a new situation such as the dental office.

The question of willingness to cooperate and the ability to adjust to new situations is, of course, more than simply a matter of mental capacity; it is properly a function of emotional growth and social maturity. It has been stated, and correctly so in my judgment, that the most disastrous effects of cerebral palsy may well be the secondary emotional effects, both on the patient and on the family. It is not surprising, then, that the child with a motor handicap is likely to be more prone to anxiety and fear which, in the cerebral palsied at least, is accentuated because of the lack of muscular control and poor equilibrium. Oftentimes, too, parental anxiety is communicated to the child, thus re-enforcing his own anxiety and setting the pattern for a vicious circle of unhealthy emotional reactions between parents and child, and even between the parents themselves because of the presence of a cerebral palsied child in the home.

Doubtless we are all familiar with the results which can readily follow: the "overprotective" parent, the "spoiled" child—or the "rejecting" parent, the "overly-aggressive" child—and so on down the list of terms associated with unhealthy attitudes and feelings. Obviously, these are not characteristic of only handicapped children and their parents; but there is probably a greater danger of them developing in the families with such children.

During my seven years of being associated with the Cerebral Palsy Clinic (now known as the Children's Rehabilitation Center) of Mercy Hospital in Chicago, I have seen over 500 children and their parents, and I am more and more convinced that cerebral palsy is not exclusively a medical problem, though of course medical science plays a vital role in the picture; nor is it entirely a social service, a therapeutic or even a psychological problem, important though these are individually and collectively in the now popular "team" approach to cerebral palsy. Fundamentally, in my judgment, it is a family problem.

Regardless of how conscientious and deeply concerned we professional workers in the field are in dealing with the general welfare of those who are afflicted and with questions of diagnosis, classification, etiology, treatment and prevention, we certainly are not the ones who experience the full impact of cerebral palsy. It is felt primarily by the family. The responsibility and burden of caring for a child with this handicap, whether he is mildly, moderately or severely involved, is largely if not wholly borne by the family—mother and father and, perhaps indirectly and to a lesser extent, any brothers and sisters who make up the immediate family circle.

We deal with this problem in a particular child relatively infrequently—at most, a couple of hours a week when he is having intensive therapy in the treatment center; otherwise at periodic intervals when he returns to clinic for a check-up—whereas his parents are wrestling with it day after day (oftentimes night after night, and no extra "pay" for overtime!), week after week, month after month, year in and year out. For, as everyone recognizes now, it is a long-range, indeed a lifetime problem and a serious one, since it has to do with the operation of the most sensitive and complex part of the nervous system: the brain. Unfortunately, there are no simple answers nor easy cures—at least medical research has not found them as yet!

As far as I can determine, no one likes to be greatly different from the group, except perhaps the radically-inclined person or the eccentric. Oh, of course, in matters of clothing, hats, hair-styles, autos and so forth, people thrive on little differences and changes from time to time. But these are quite superficial and are customarily accepted without question and without any reflection upon the integrity of persons indulging in such socially approved variations in fashions and tastes. The difficulty arises, however, when a person's facial and bodily appearance, his speech or perhaps only his actions and general behavior, differ grossly from the expected pattern. Under such circumstances, when faced with these deviations, most people feel very uneasy and uncomfortable; they naturally become overly curious in their attempt to learn the whys and wherefores of the strange phenomenon suddenly in their midst; and some seek to relieve their tension by being very inconsiderate and unkind. In general, people are afraid of what they do not understand.

Obviously, the parents of a child with cerebral palsy, in addition to the inner anxiety and disappointment which they feel over his failure to develop normally, are faced with this external, social pressure of nonconformity. They have little if any success in hiding the fact from outsiders that they have a youngster who is strikingly different; sooner or later the truth is known and the inevitable questions will have to be answered somehow. Thus, long before the child has grown up to the point where he appreciates the full implication of his physical difference, his parents have faced it countless times, successfully or otherwise. Whether one way or another, they have had to make some kind of an adjustment—to each other as the mother and father of a child who is different, to the child himself, and lastly to relatives, friends and neighbors outside of the immediate family circle.

From the standpoint of mental health, one can only say that it is much better for parents to be completely frank and open in discussing the child's difficulties with any interested persons. Fortunately, this task of being forthright is made easier these last few years because of the widespread publicity given the problem through TV programs, radio and the press, for which such agencies as the United Cerebral Palsy and the Easter Seal Society are largely responsible. People are bound to ask questions; and the more they know and understand about the condition, the easier it is on parents and children alike. Naturally, the parents need to know and understand as much as possible about the disability, so that they themselves are not confused and fearful regarding it.

After all, parents *are* human beings, and they enter the marital relationship with mixed feelings and attitudes, hopes and fears—some hidden but still powerful,

others openly expressed. The advent of an exceptional child is quite liable to upset the otherwise harmonious relationship of husband and wife to the point where the whole family is living in a state of perpetual tension, and the marriage is consequently jeopardized. Obviously, the afflicted child, having suffered damage to the higher centers of the nervous system, is not as able to tolerate such an emotionally-charged atmosphere without showing adverse signs.

Naturally, it is necessary to do all that can be done in the way of counseling and guidance to maintain a healthy marital relationship and a sound pattern of family living, or to re-establish it if it has been lost. The cerebral palsied person and his family have to learn to live with the problem of being conspicuous and different, of being socially non-conforming! Naturally, it is a problem calling for some kind of adjustment at various levels and in all aspects of social life—not the least of which is the challenging experience of going to visit the physician or the dentist!

In order to elicit from any patient that willingness to cooperate and to perform to the best of his ability, which is so essential in dental work, the dentist must be a skilled and understanding psychologist in his own right, as you doubtless know from long experience with so-called "normal" persons. The same applies to the patient who happens to have cerebral palsy—only more so! By this I mean that, since he lacks voluntary muscular control and has great difficulty in relaxing properly, he needs a maximum amount of kindly reassurance from someone who has the knack of radiating confidence—simply as a means of offsetting anxiety. Unquestionably the best way to ease his tension and involuntary muscular movement is to keep the conversation light and strictly away from any reference to his handicap. Especially in the case of the alert, intelligent, sensitive patient is there the greatest need for the dentist to create a psychological atmosphere which will help to counteract his deep-seated anxiety and fear born of self-consciousness about his condition. Working with the handicapped in general and with the cerebral palsied in particular can be a challenging and a satisfying experience which I feel certain you will welcome in the spirit of the pioneer who explores a new country.

I should like to close on a philosophical note. It seems to me that parents, as well as those who are striving to help them and their handicapped children, will do well to reflect in their attitudes and behavior a strong, dynamic religious outlook. Simply stated, regardless of a specific creed or dogma, such an outlook embodies Man's age-old belief in a Power or Supreme Being greater than himself, who is his Creator and the ultimate Source of his strength and hope. Only by thus believing in the purposefulness of human life generally and the individual worth of every child, however handicapped, can we truly be successful in our combined efforts to help solve the problems created by the handicapped child, whether in the home or in the community.

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Control of the Dentist in the Management of the Child Patient*

ARTHUR I. KLEIN, D. D. S.

Dr. Arthur Klein is a graduate of the University of Pennsylvania Dental School, class of 1947. Upon discharge from the U. S. Navy Dental Corps in 1952, he became a part-time faculty member at the University of Indiana School of Dentistry as Research Assistant in Pedodontics. He is working toward the master's degree and has entered into private practice limited to Dentistry for Children.

The little girl undergoing dental "treatment" in the photographs is Barbara Sue, five-year-old daughter of Dr. Klein.

WE ALL are aware that dentistry for children is one of the major problems in the dental profession, and it is gratifying to know that dentists are spending more time in this field today than ever before. Their work, however, merely is a beginning.

One of the major stumbling blocks in dentistry for children is the problem of child management. In reviewing the literature on the subject, we find that a great deal has been written and that there have been many excellent articles in which the types of behavior patterns of children in dental offices are described, along with suggested modes of treatment. The fears of a child and the psychological approach to overcoming these fears have been investigated, but there is room for further study. Jersild states,[1] "Fear arises when we know enough to recognize the potential danger in a situation but have not advanced to the point of complete comprehension and control of the situation."

Basically, there are five factors involved in the handling of the child patient—the patient, parents, environment of the office, office personnel, and, unfortunately, the least discussed factor, the dentist. It is expected that the dentist have the technical ability and knowledge to render a satisfactory dental service, and with this the discussion ends.

In an effort to find a pattern of behavior and thus establish a particular characteristic for each type of child, we have made tape recordings at the chair of a number of children who would be considered management problems. Presumably, this would be followed by a method of handling the child for each characteristic behavior problem. Upon reviewing the recordings, however, the following facts were quite evident:

1. There were no characteristic behavior patterns.
2. Each child responded differently under similar circumstances.
3. There is no set technique for handling the child.
4. The control of the dentist in the management of the child is of prime importance in order to render successfully a good dental service for the child.

There is no doubt that the young patient can sense immediately when people closely associated with him are upset or disturbed, and such is the condition of most parents bringing their children to

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the dentist for the first time. The child, therefore, is upset, but the dentist easily can overcome this unpleasant situation and eliminate it.

Assistant Plays Important Part

To illustrate this point, it might be instructive to follow a child and mother through the office and note especially the attitude and conduct of the dentist. The assistant makes the first contact with the patient and parent, where a good deal of important preliminary information may be gathered by trained observation. In greeting them she naturally is pleasant, and immediately conditioning of the child begins. The assistant explains that there are playthings, books, etc., for the child's use in the waiting room, and she conveys the idea that children are welcome in the office. The thought that other children come here helps the child to understand that this is not an unusual situation. By discreet questioning of the parent, the assistant can obtain such information as what childhood diseases were experienced, the last physical check-up, behavior in the physician's office, what dental experience the child has had, and whether this experience has been pleasant or otherwise.

An important bit of information is the dental experience of the mother. Hagman[2] reports a correlation obtained between the fears reported for children and those admitted by mothers. He suggests that approximately 44 % of the child's fears are accounted for by the mother's fears. This information is given to the dentist and the child then is invited to come into the office by the assistant.

The invitation is given in this manner:

"Mary, Doctor would like to look at your teeth. Come with me, please."

At the same moment, she gives her hand to Mary. If mother starts to come, too, the assistant merely says, "You may wait here and doctor will speak with you shortly."

If there is any difficulty about the child coming into the operating room with the assistant, she is not to pursue the matter further. Assuming that the child refuses to accompany her, we have a situation in which the child is either basically frightened or spoiled. There are many categories of behavior in which the child's actions may be placed, but at this point it is only necessary for the dentist to make this important decision of frightened or spoiled—and many times both conditions are present.

Attitude of Complete Control Is Essential

Control of the dentist is especially important now because he will start to condition the child to his presence and mode of operation. To be successful in handling children, it is necessary for the dentist to love children so that they immediately know that that is the case. By this we mean not the time-worn thought of "Certainly, I like children." The attitude of actually loving the child cannot be overemphasized. The dentist also must develop an attitude of being in complete control of the situation. We are aware that self-confidence is a great asset; and confidence in one's ability, technically, to accomplish a dental service for any child is quite important. The dentist must have the attitude that this child is nothing unusual and that everything will be fine. Both the child and parent can sense this air of confidence and ability in the dentist. The atmosphere is contagious to office personnel, too, which is very helpful.

On approaching the child, the dentist should bend down to her level as his assistant introduces him to both parent and child. After a moment of small talk such as, "Isn't that a lovely dress, Mary," he

FIG. 1. Contact may be attained by stroking the child affectionately on the forehead so that she knows that the dentist wants to be her friend.

FIG. 2. Contact with the child, while proceeding with the dentistry, by placing the hand comfortably on the side of the face, is very helpful.

may offer the child his hand, thus making bodily contact in order that she may feel that the dentist is absolutely calm and in full control of the situation. This procedure of bodily contact (Figure 1) may be attained by stroking the child affectionately on the forehead, so that she knows that he wants to be her friend. Children placed in a new environment and strange surroundings are without security; they must be shown by actions as well as words that a genuine interest in their comfort and a true liking for them as people is present in the person of the dentist.

CHILD MUST FEEL SECURE

From birth, we all crave a feeling of security. This may be brought out strongly by observing a mother receiving her first new-born child. When the nurse brings the child into the hospital room, the child generally is quiet and comfortable; however, the moment he is given to the mother the infant begins to fuss and cry. There is good reason for it. The nurse is calm and goes about the procedure of holding the infant with an attitude of complete confidence, and the child feels secure by bodily contact. Upon contact with the mother the infant immediately senses the excitement and uncertainty and no longer is comfortable and secure. Therefore, contact wherever possible (Figure 2) while proceeding with the actual dental procedure is of utmost importance.

After meeting the child, the dentist merely leads her into the operating room in a confident manner. There is no doubt that the child will come with him, and it is expected that she will do so. Generally, this overcomes many problems. Should the child misbehave, however, the doctor must decide whether she is badly frightened or just spoiled, or both. In either case, calmly, with a firm but slow motion, the dentist may pick up the child and turn to the parent with a reassuring yet firm and kind remark, such as, "Mrs. Jones, you may wait for Mary and me here. Mary will be fine." Then he may try to cuddle the child's head on his shoulder and quiet her by talking softly and reassuringly in a calm monotone.

The first requirement is to get the child to be quiet in order that she can hear what the dentist is saying. Usually, in the frightened child this can be accomplished by continually talking to her and diverting her attention. Sometimes her attention can be directed to the rubber prophylaxis cup by polishing her fingernails and then continuing to the mouth for a prophylaxis of the front teeth. This is done while the child is making noise. Perhaps she continues to make noise and the dentist has reason to believe that he is dealing with a spoiled or a frightened and spoiled youngster.

Firmness Sometimes Required

In any event, it is best to give the patient the benefit of the doubt, to tread softly but firmly, to try being kind yet gentle and firm; and, if all this fails, gently but firmly placing the hand over the mouth to accomplish one thing only—stopping the noise. Then the dentist may whisper into the child's ear, "We have only good children here. As soon as you stop making noise, I will take my hand from your face. Please place your hands in your lap." Repeat this in a whisper so that the child must stop making noise in order to hear you. The thought, "Place your hands in your lap," is taught the child immediately. It is much better than, "Put your hands down," because everyone tells the child that, and he resents it. In short, the continued calm, gentle, firm, affectionate attitude of the dentist is the necessary ingredient for success in managing the child.

Once the child becomes comparatively quiet, the dentist continues to talk and explain about the rubber toothbrush which will clean her teeth and that if she is a real good girl he will take a picture of her teeth. All this time he has continued bodily contact by placing his hand comfortably on the side of her face. Now the patient hears the dentist speaking calmly yet firmly and gently, sees him operating in a definite procedure, and realizes that he will continue no matter what the child does. After accomplishing the prophylaxis and possible radiographs, the patient is dismissed. The parent is told at this time to be sure to compliment the patient on the fact that she has been a fine girl. The parent is told, too, that it would be better not to discuss dentistry with the child. Any questions as to what the dentist is going to do next time should be answered with, "I don't know, but I'm sure if you ask the doctor he will be happy to tell you."

Second Visit Usually Happier

On Mary's second visit to the dentist, the assistant again greets the parent and child and she attempts to engage the child in light conversation. Mary will be a bit more friendly, yet hesitant, for she still is wondering when the doctor will hurt her as she supposes he will do. However, because she had a rather pleasant first visit and everything seems familiar, Mary is now settled down and can notice the happy attitude of the office while taking advantage of the playthings in the waiting room. When ready for Mary, the assistant merely says, "Come with me, please." Generally the child will follow, but if there is fussing, the assistant does not insist but allows the doctor to bring the child in as was done on the first visit.

"Mary, we are going to take pictures of your teeth today. Won't that be fun? Here is the camera. Touch it. Here we have the paper on which the picture will be made, feel it." The dentist should be sure that the child has a chance to feel, taste and touch the film before proceeding. In the pre-school child, the flat plane technique is preferred[3] for the an-

terior teeth. It is simple for the child to manage. The anterior radiographs are taken first to acquaint the child with the procedure. Then the posterior films are taken. If there is a gagging problem, the procedure of asking the child to breathe through her nose like a little dog often helps. Also, sprinkling table salt on the child's tongue and allowing the child to swallow is of assistance. It is done in this manner:

"Mary, stick out your tongue." (The dentist sprinkles a little salt on the tongue.) "What does it taste like? That's right, it is salt."

Upon completion of the full-mouth radiographic survey, during which the dentist has had an opportunity to learn more about the child, the preliminary charting is done and the child is dismissed.

Third Visit Sees Actual Dentistry

When Mary arrives for her third visit, again she is invited to come in by the assistant, and at this point the child rarely balks. If there are any objections, however, the doctor takes over and usually actual dentistry begins. This time we wish to prepare and fill a small cavity under local anesthetic, and, if possible, a labial or buccal cavity is selected or some simple preparation.

"Mary, did you know that we can put your teeth to sleep while you will be wide awake? Your lip will be sleeping, your tongue will be sleeping, but you will be wide awake. Isn't that something?"[4] (As the dentist proceeds with this conversation, he proceeds with the injection, telling the child what will be done—and then doing it.) "First, we rub this cotton on your gum like this and soon it will be sleeping. Is your gum sleeping now? That's good. Then we will squirt some sleep medicine on this cotton and soon your tooth will be sleeping and you will be wide awake. That's funny, isn't it? There, your tongue is feeling funny already. Mary, we are going to take the sugar bugs out of your sick teeth and make them strong and healthy again. This is our sugar bug 'digger outer.' See, it makes noise; but we don't mind the noise because we are going to make your sick tooth a happy tooth." (The doctor may try the burr on the child's fingernail, putting initials on it.)

It is necessary to wait a sufficient length of time to be sure that the area is well anesthetized. If no pain is caused, there will be a much less difficult patient.

"Now, Mary, let's chase the sugar bugs out while Millie blows them away. Mary, look right at me and you will see the sugar bugs fly away." If the child fusses during the beginning of the cavity preparation, the dentist watches the pupil of the eye. In all probability, if there is a dilation of the pupil, the child is feeling some pain. If there is no dilation, the child probably is trying to talk the doctor out of the procedure. Upon completion of the cavity preparation, and when the dentist is ready to restore the tooth with amalgam, the conversation continues, "Mary, we are going to give you a genuine Mickey Mouse filling. You listen carefully and perhaps you will hear it squeak as it is placed in your tooth. That sure is funny, isn't it? You have been a real good girl today, and we are very proud of you. Be sure to show Daddy your new Mickey Mouse filling. He will be pleased. Goodby, Mary."

Rubber Dam Is Used

When Mary returns for her next visit, the dentist anesthetizes the area by using the same technique. At this time, however, it is advisable to place a rubber dam for any further operative dentistry.[5] The child is more comfortable with a rubber

dam for these reasons:

1. The child's tongue and lips are not constantly being pushed about but are placed out of the way. 2. There are no tooth and amalgam particles to make the child uncomfortable. 3. Once the rubber dam is in place, there is no necessity for rinsing and packing the mouth with cotton rolls. All that is necessary is to get the child to relax.

For some reason, the thought of placing a rubber dam on a pre-school child or any child sets up an insurmountable obstacle to many dentists. The technique, using the Youngs Rubber Dam frame and the Tocchinni Rubber Dam clamps for primary teeth, is mastered easily. The placing of a rubber dam on a child can be done more efficiently than on an adult because of the anatomical constriction at the neck of the primary tooth which retains the dam on the neck of the tooth. The rubber dam also is useful on a child who is spoiled and continues to make noise. Many times, after the dam is placed, the child realizes that there really is no reason to continue fussing. We have found a number of instances of so-called behavior problems relaxing to the point of falling asleep in the chair while the dentistry was being completed with the rubber dam in place.

"Mary, is your tooth sleeping? That is fine. Now we will put a funny face on your tooth. This is going to be real fun. My goodness, I'll bet that you never have heard of a tooth with a real funny face. Well, this is going to hold the funny face on your tooth." (The dentist places the rubber dam clamp.) "It will feel a little tight but you won't mind that, will you? That's fine. Now, here comes the funny face. Open your mouth real wide like a garage door. There, that's fine."

Dentist Experiences Sense of Satisfaction

The control of the dentist has been demonstrated by following Mary through her first few visits. The words used in the conversation are of little value in themselves. The manner, tone and sincerity of those words are of great importance, however. There is no doubt that the child very easily can sense honesty and sincerity. She must be convinced in a short time that (1) the dentist really is concerned about her comfort and dental problems; (2) he will do everything to make her visits to the office as pleasant as possible; (3) he expects and demands complete cooperation; (4) he is absolutely confident that he can and will render the proper dental service to the child.

We do not believe that it is possible to describe the feeling of satisfaction which one receives upon meeting a pre-school child who is a management problem, slowly calming the child to the point where a good deal of dentistry is accomplished at a particular visit, yet having a happy patient.

If the dentist asks the question "Mary, did you bring me a hug?" the child will in almost every instance shower him with affection. Somehow, the difficulties of controlling the dentist melt away and all is fine with the world. There are many rewards in children's dentistry, but a child's honest affection has no fee for services rendered.

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A Re-evaluation of Vital Pulp Therapy

Editor's note:

The accompanying transcription of the panel discussion on pulp therapy, presented at our 1955 A.S.D.C. Meeting, is printed at the request of many members who were present at the original discussion. It was impossible for us to obtain the slides mentioned by the discussants in their presentations, but on the whole, the program is just as interesting and informative reading as it was listening. We hope you agree with us.

A. E. S.

PANELISTS

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Moderator: I. IRWIN BEECHEN, D.D.S., F.A.C.D., Assistant Clinical Professor of Operative Dentistry (Postgraduate Courses) College of Physicians and Surgeons, A School of Dentistry, San Francisco, California. Diplomate, American Board of Pedodontics.

DR. BEECHEN: We have about an hour for the purpose of re-evaluating the treatment of vital exposed pulps. Before you came here this morning, each of you no doubt had in his mind what he considered to be proper treatment of vital exposed pulps, and chances are that when you leave here, you will still feel that is the way to treat them. But I think that it is interesting to hear and see other people's work so that we can, in our own experience, perhaps reconsider our prefixed ideas. I am going to introduce the panelists and each man will have about three minutes to explain what he has experienced in the treatment of vital pulp therapy. As you will see, we have a definite difference of opinion among the four panelists represented; and as Dave Law said, "A whale does not get harpooned until he rises to the top". I really like that, Dave, and I think that you rose, you spouted, now let's see you get harpooned. I have always wanted to see a whale harpooned. We will call on our panel in the order in which they originally appeared. First, John Sowden, of the College of Physicians and Surgeons, who is doing research there. This problem is not new to him, for he has been carrying on a study for a number of years. He

reported it two years ago at a seminar, and it was an old study at that time. It is a controversial study. It is worth considering, and I will call on John Sowden who may show a few slides to recap his original report.

DR. SOWDEN: (Slide I) This is a slide of a 34 year old patient, and it is very evident that the caries involves the pulp in both of these molars. (Slide II) This is a way of doing a calcium hydroxide treatment. Dr. Jack Fields put some calcium hydroxide over the caries and then he placed zinc oxide, eugenol and guttapercha on top of that and the caries was very soft. (Slide III) This was several months later and it is very obvious what happened. You see that there is starting to be a calcified area, a white area, as I showed you this morning. (Slide IV) This is a 10 year old girl and it is very obvious that there is caries near the pulp here. We treated it and you can see the white line runs right on through. And as time goes on the same thing is taking place there. Here is one of the later slides—a decalcified upper molar. The lighter pink area is normal dentin. The dark area in this section is recalcified caries. This is the pulp tissue and here the dento-enamel junction. The other two slides came from this area here, and is this far away from the pulp. There were no inflammatory cells in the pulp. The dark area in this slide is the matrix and in between the dentinal tubules. Now this is from the same area in the first slide. This is the caries area I showed you a moment ago. This is new tissue, new dentin in the area that had been carious. The pattern is very consistent all the way through.

DR. BEECHEN: Basically, as I see what Dr. Sowden showed this morning, and I believe I am correct, he has left gross caries, which is contrary to all our dental school teachings. He places calcium hydroxide over that gross caries and over that is placed amalgam. The slides which he has shown you illustrate that technic. If you have any questions, we will discuss them as we go along. The second man who spoke this morning represented the Vancouver British Columbia Study Club, which is a very much respected and well known Pedodontic study club. Dr. Max Nacht spoke on the management of exposed pulps, the study covering a five year period. We will ask him to recap his report.

DR. MAX NACHT: For a recap of our technic and some of our conclusions, the technics were basically the same as we had employed with calcium hydroxide, except for the change in the drugs.

1. Anesthesia and rubber dam application
2. The routine preparation of the tooth for the reception of the permanent filling material
3. The complete removal of the wall over the pulp chamber
4. The removal of the bulbous portion of the pulp
5. The control of the hemorrhage
6. Adequate quantity of mummifying paste was applied to the stumps immediately after. The paste was mixed to a very thick consistency and pressed down with a damp cotton pellet
7. The placing of a hard cement over the paste as a firm base for the filling material
8. The placing of a permanent filling material.

Now our results run up to five years, though in some of the cases the primary tooth was lost after three or three and a half years, some after four years. Occasionally we did start with the very young, and we managed to keep it up to five

years. The results our studies showed, basically, were no change in the bifurcation, no change in the clinical evidence for the first two years; and at that time we were pretty enthusiastic about it. We still are, to a degree, but after two years the picture changed considerably. We found that after that length of time bone in the bifurcation began to disintegrate, and as time went on it was completely lost. The end result was the early loss of the primary tooth, and as a consequence, the early eruption of the permanent tooth. Thirty out of 467 teeth were lost, but the remainder of which we have record remained comfortable in the mouth until they were lost through exfoliation. The early loss of the primary tooth and the early eruption of the permanent tooth did not seem, in most cases, to result in any loss of space because eruption of the permanent tooth followed very rapidly.

DR. BEECHEN: Thank you, Dr. Nacht.

The third man to appear this morning was Dr. David Law on his evaluation of the vital pulpotomy technic, and because some of you were at other meetings or came in late, I would like to have him again recapitulate his report.

DR. LAW: This will be very brief, and is for the benefit of those who came in in the last few minutes. We have an old saying, "The mind will only accept what the bottom will endure". I don't want your bottoms to get too tired! I reported on 274 cases of vital pulpotomy using calcium hydroxide, which were done by students of the University of Washington. It covered a period of approximately, all together, five years; but the average of the cases was between 9 and 12 months. We had success in 44% according to clinical x-rays and checkups. We further found that, for instance, the percentage of failure in primary molars was significantly greater in the mandibular arch than it was in the maxillary arch. I would like to make a plea for further clinical study on whatever technic it is that you are using, with x-rays, so that we can evaluate these things and not just talk about them.

DR. BEECHEN: Thank you, David.

The fourth man at the head table has not been introduced previously this morning. He was asked to appear on this panel because we felt that he would round it out and bring to us an attitude that was not completely in accord with the other three panelists. We did not bring him along to give anybody a bad time, so to speak. Ralph McDonald is a graduate of the University of Indiana and Professor of Pedodontics at the University of Indiana. Rather than go through his career, I would say that he was honored yesterday with one of the highest honors that can be accorded to a man in Pedodontics. He was made a member of the Board of Examiners of the American Board of Pedodontics. So I need say no more as to his qualifications, or the high respect the profession holds for him. I am going to allow him a little more time because he heard the three essayists' papers this morning and also had advance copies of the papers. He is prepared to further evaluate their reports.

DR. RALPH MCDONALD: Thank you Dr. Beechen. Members of the ASDC and guests:

There is one important aspect I think we should not lose sight of. Are we blaming a method or a material for success or failure, when actually perhaps we should be blaming a method of the collection of cases, or perhaps our ability or inability to properly select cases? Our experience with vital pulpotomy using the calcium hydroxide technic was much the same as that reported by Dr. Law. We have a rather high percentage of failures. We

analyzed our failures and some of my colleagues who helped with that are in the room this morning. We went over the records, examined those where we had a very complete history at the time of the operation; and, one or more of the following points became evident. In a great many cases, there was the history of preoperative pain. There was not a severe pain, perhaps not enough to keep the child awake for a night or two, but rather a spontaneous type of pain. And Dr. Law mentioned it was a very important diagnostic point, one which perhaps could rule out any type of vital pulp therapy. Another thing we noticed on the record many times was that of excessive hemorrhage, either when the pulp was exposed or during the pulp amputation. There was a time when we used adrenalin routinely to try to control this hemorrhage, as well as other hemostatic agents that are on the market. In a great many cases we found that there was a record of a temporary restoration following the pulpotomy, particularly a cement restoration. There is good evidence in literature that such a restoration will not adequately seal the cavity, at least for more than a few hours. In other cases of failure, there was a record of eugenol having been sealed in in contact with the vital pulp for a period of time before the pulpotomy was performed. Then, of course, some will have no reason at all. We couldn't determine the reason why the pulpotomy failed. What did all this mean? In an attempt to find out, over a period of time, we collected over 50 primary teeth which had pulp exposures. These were collected from a group of patients most of whom came into the hospital with some history of a systemic disturbance which we felt contra-indicated this type of vital pulp therapy. Or they were collected from mentally retarded children where it was impossible to carry out pulp therapy. Many of these teeth, as we observed, presented a history of clinical symptoms similar to the ones I just mentioned. The teeth were extracted and histological sections were prepared; and I would like to take a minute or two to show you some slides to point out some of these important diagnostic features that we should not lose sight of. First of all, this is what I would consider to be a normal pulp. This is what we would expect to find in a mechanical or pinpoint carious exposure where you have only a small amount of inflammation but the pulp is essentially normal. This is the type that you would expect to recover from the pulp cavity. However, in the next slide we see a different situation. I want you to notice the first primary molar, and I think most of you will agree that this looks like a good candidate for vital pulp therapy. There even looks to be a bridge of secondary dentin sealing off the pulp and protecting it. However, when the caries was removed there was excessive hemorrhage at the site of the carious exposure—hemorrhage that very quickly filled the unexcavated carious material. In the next slide we can see a histologic section of that tooth and the entire coronal portion of the pulp and down into the canals showing more inflammatory cell infiltration. In other words, the marked inflammation was responsible for the hemorrhage. Now, I think many times this is what we have when hemorrhage is very difficult to control. We have to resort to hemostatic agents. To me, whenever you have excessive hemorrhage, it means that we have degenerative changes and we are not dealing with a pulp that is likely to succeed under conservative methods of treatment. (Next slide) Now another case where the x-ray findings were normal. However we have a larger exposure here

where we have a leathery mass of dentin. And in this section we see a larger exposure. (Next slide) Here we see a considerably larger amount of degeneration in the pulp horn and even down at the opening of the canal we see what may be a beginning of an abscess formation. So perhaps we should consider the size of the exposure. As the exposure increases in size we are more likely to have an extensive type of degeneration, perhaps even at or beyond the point that we could amputate the pulp. (Next slide) In this slide again we see what Dr. Law referred to as some evidence of density or calcified mass in the pulp chamber at the entrance of the horn. (Next slide) This, too, was quite often associated with extensive degeneration. Here we have evidence of a hemorrhage at the site of very large exposures and evidence of calcification beginning to take place here, and opposite that, a large pulpal abscess even in the opposite canal. (Next slide) Here again where there is evidence of the calcified mass in the radiogram we see a dissection which is again associated with extensive degeneration and inflammation of the pulp tissue. This, I look upon as a defense on the part of the pulp to try to wall off the irritant and the carious lesion is progressing too fast for the normal secondary dentin to be laid down. There is something else I want you to notice in this section. Notice the inflammation—going on down the canal in the tissue where there would be bleeding and inflammation. Notice that we have the beginning of a small area of internal resorption, and it is my personal belief that when we see evidence of internal resorption soon after we carry out a vital pulp procedure, that perhaps we were dealing with a pulp in some stage of inflammation and the resorption had already begun. Of course, we could not detect this radiographically. It is my feeling more times that the resorption is already under way at the time we did the pulpotomy; and we are too inclined, I think, to blame our procedure or our material for the later findings.

So perhaps we should evaluate our cases a little more carefully, select them carefully, and restore them adequately so that the teeth will not leak and contaminate our vital pulp. Then, of course, there are cases where we have the degeneration for no apparent reason. I think you all agree though, that primary teeth many times do not present clear cut symptoms like our permanent teeth do. Many times we have marked degeneration without any history of a toothache. So I think that is why, perhaps, we have a greater success in the case of permanent teeth. They present better symptoms and we know where we are to a greater extent when we begin our operation. Thank you.

DR. BEECHEN: Thank you Dr. McDonald.

I have many questions that have been presented to me and we will try to get to as many of them as possible. I will try to select questions that we can spread around among the panelists. Naturally, we cannot allow further questioning from the floor because it is time-consuming. We get into arguments, and I think it will run smoother if we don't. If there are any further questions, just bring them forward. I am going to start with Dr. Sowden again, but not because I'm trying to harpoon him. Dr. Sowden, this question has been asked of you. If any of the other panelists would like to comment on these, if you will raise your hand or look at me you will be allowed to do so, and please do not give another paper when you answer the question. We just want the answer to the question! If you don't know, just say so.

Question: Is increased radiopacity due

to calcium deposition or increased density due to heat due to dehydration? Can it be due to penetration of metallic ions from the amalgam?

DR. SOWDEN: *Answer:* I do not think I can give you the answer that you want, but I can tell you that when you take the alloy out and check it, there is no discoloration on the alloy. The increased white area seen in the histologic slide appears in the tooth as reconstructed dentin. That is where the histological section was taken from. The only thing I can tell you is that I think the calcium hydroxide has stimulated the odontoblast cells into their normal function which is to calcify.

DR. BEECHEN: Just to labor the point a little bit, have you altered your treatment at any time by placing anything other than calcium hydroxide over the caries and have you used other agents than amalgam for sealing the cavity?

DR. SOWDEN: I tried zinc oxide to see what success I would have with it, and I got absolutely none. So I stayed with calcium hydroxide and water.

DR. BEECHEN: This next question is one that I would like any or all the panelists to discuss because it is a basic question in evaluation of radiographs of primary teeth. *The question is:* Is bone in and around a primary tooth root end different in response than that around permanent teeth? Can we actually see on x-rays chronic infection in the surrounding cancelous bone?

DR. RALPH MCDONALD: In answer to that question perhaps I should mention something else that we should consider in the diagnosis. It has been reported that there can be involvement of the pulp in the canal and also periapical involvement in the bone. Early changes that will not be evidenced radiographically. So perhaps we could have an involvement following pulp therapy that would not be evidenced radiographically, at least would not be evidenced early.

DR. BEECHEN: Would you comment on that, Dave?

DR. LAW: Frankly, I think that we are using the same criterion that we have used in examining the ends of permanent teeth for pathology.

DR. BEECHEN: I think the question basically is: Can you determine radiographically the bone condition around the primary teeth as compared to the bone condition around the permanent teeth, the assumption perhaps being that bone is undergoing a change as tooth eruption and root resorption occurs. Is that the way you put it Dave?

DR. LAW: Well, not exactly, but I think it is true, that sometimes around the erupting permanent tooth we see some difference in the contour of the bone, in the texture of the bone, but in verifying the condition of the bone of a primary tooth, examine first a side which has pulp therapy and then examine the other side which is not undergoing pulp therapy. Compare and get a picture of what is normal in that child at that age. It seems to me that using the regular standards of evaluation of the periapical pathology, you should be able to tell whether it is typical bone or not. I think that using the other side of the child's mouth so that you get an idea of the normal picture, that you can do it. What some of the other factors involved are, I do not really know.

DR. BEECHEN: Dr. Nacht, this question is directed to you. *Question:* If the requirement for nonvital is the same as for the vital pulpotomy, why destroy vital tissue?

DR. NACHT: *Answer:* It is our experience that it was definitely not the same. We seemed to have some degree of success with "vitals" with calcium hydroxide if we were very, very careful in our

choice of cases. No history of prolonged pain no history of sudden pain, but in the technic that we used, I said that the only criterion was that the tooth had to be vital by virtue of the hemorrhage at the site of amputation. We had all types of cases—teeth that had been aching for two or three days, teeth that have suddenly started to ache violently; and any kind of tooth as long as the pulp was not in an abscessed condition—as long as it was vital by virtue of the hemorrhage etc. So we felt that our range was much wider. I am talking now from a practical point of view. In an office you get everything from one extreme to the other and a great many of them were very, very bad and that is why we felt that this treatment was probably better for us from a practical office point of view.

DR. BEECHEN: I am going to start with Dr. Sowden now and go right on down the line and see exactly how you feel about this next question. *Question:* What emphasis do you place on the physical health of the child in selecting your cases?

DR. SOWDEN: First, I would want to be certain that the tooth would respond to treatment, and if there was a health factor in the child and it would ruin the child's health, then it would not be done.

DR. BEECHEN: Would you take the same question, Dr. Nacht?

DR. NACHT: There is no doubt in our studies that if there were any systemic conditions that might be aggravated by the use of the treatment, such as a chronic heart condition, we do not do any pulp therapy on children who have systemic conditions such as congenital heart conditions, allergies, etc.

DR. BEECHEN: To carry this a little further, in some clinical cases in which there is not a history of frank illness, but the child is not up to par, do you think that that affects the possibility of success or failure in your treatment?

DR. NACHT: No, I do not.

DR. BEECHEN: Dr. Law, would you take the same question?

DR. LAW: All I can say is unless the child has a valvular heart condition or rheumatic fever, I see no reason for not doing pulp therapy.

DR. RALPH MCDONALD: I think that the physical condition of the child is a point that we overlook. Too many times we are concerned with the appearance of the tooth, etc. I do not know of any work that has been done in humans. However, Glickman reported this in the Journal of Oral Histology and Pathology in 1954. He worked with experimental animals. He reproduced protein deficiencies, diabetes and several debilitating diseases. And he observed in experimental animals suffering from systemic disturbances that there was a degeneration of the odontoblast layer. He pointed out that perhaps in the humans if there was some illness or disease that we might *not* experience pulp healing. And earlier this morning it was mentioned that some have observed where pulp therapy failed in one mouth, and several teeth became non-vital. To me that would be additional evidence that perhaps that child did not have sufficient resistance, if you want to use that term, for the pulp to repair itself.

DR. LAW: I would like to comment on that. It seems to me that if you work on the child in the dental office you are going to work on him when he is well—after he has gotten over the illness. It would seem to me that unless this youngster is not healthy, we really do not know enough about him not to at least give him the benefit of pulp therapy.

DR. BEECHEN: Dave, here is a question directed at you. I am going to add some more to it so don't answer until I finish.

The *question* is: Would you expect any difference in results of a vital pulpotomy if you used U.S.P. calcium hydroxide as contrasted to C.P., referring to chemically pure? When would you use the non-vital pulpotomy, and when would you use the vital? There are on the market some prepared calcium hydroxide products that are mixed with oil of cloves. Do you feel that in your pulp therapy, calcium hydroxide that is mixed with the bleeding or the water is more effective than one that is mixed with the oil of cloves preparation?

DR. LAW: Well, I don't know actually. Unless you took a whole bunch of people and tested the difference of these, you could not make a scientific evaluation. Personally, I think that it would not make any difference whether you use C.P. or U.S.P. calcium hydroxide because in the German literature they reported the successful bridging using calyxl, which was a mixture of calcium hydroxide, calcium phosphate and other things. Since they used a calcium mixture, I do not think it makes too much difference. I think that perhaps the elevated pH has the most to do with it. Now, first, if there is a commercial product mixed with eugenol, I would be inclined to look with disfavor on that. In the case of one commercial product that I am aware of, it is mixed with methyl-cellulose (which I think is absolutely inert) and I would expect you would have equally good healing with that; and I think there is good evidence in the literature that this has actually occurred. So I think that product would be satisfactory. When do we use a vital pulpotomy, and when do we use a devital pulpotomy? Well, it is a matter of terminology. A doctor by the name of James Fleege, who has done some work on Rhesus monkeys, showed that when you excavate the pulp and do what is called the devital pulpotomy, using formalin, that in the monkeys at least the pulp remained alive. It did not devitalize. Actually, they undergo a kind of chronic inflammation and stay alive. We feel that we are probably going to find out that these so-called devital pulpotomies in the humans are not devital at all, but that they maintain vitality. When do we use one method and when do we use the other? I do not know, personally, at the present time. We had originally hoped that the use of the devital technic would be more applicable to the case that would be a poor risk for the vital pulpotomy. Where you suspect more degeneration in the pulp because of the hemorrhage at the site of the exposure, maybe you could use the formalin technic, assuming that it would be more successful. I do not really know whether it is or not yet, and maybe it is. But I would say at the present time that the indications for one or the other would depend on what you are using, and what you are familiar with, and maybe later on studies will show which is best.

DR. BEECHEN: Are you doing any work with non-vital technic now?

DR. LAW: Yes, we are.

DR. BEECHEN: I have four questions that are all related. They are for Dr. Sowden. They are so similar in content that I thought I would present them all and then you could answer them as one. The first question is: Do you re-excavate after treatment with calcium hydroxide before you consider the restoration completed? 2. Have you seen a re-infection by extension of caries in the remainder of the dentin? 3. Should re-excavation of the caries be done to prevent this? That is practically the same question. 4. Can you tell us your percentage of failure?

DR. SOWDEN: The alloy is only used as a method of sealing in the calcium hy-

droxide; zinc oxide and other things are very unsatisfactory sealers. After the white area has shown up sufficiently, and everything is going along normally, that alloy is taken out and the calcium hydroxide remaining is washed out. The whole area is cleaned and then you whitewash with calcium hydroxide and water. Then the remnant of the whitewash on the margins is removed and new alloy is placed back in again. This is in the primary dentition.

DR. BEECHEN: I am just curious. You did not show us any case of failure by re-extension of caries. Have you had any of these cases?

DR. SOWDEN: A case of re-extension of caries?

DR. BEECHEN: Yes. You have not had a case where the caries seem to reactivate?

DR. SOWDEN: No.

DR. BEECHEN: You must have had some cases where you had to extract teeth.

DR. SOWDEN: The failures were in the adult teeth, where those in which the alloy or whatever it was filled with had broken, had come out or the tooth had cracked. Of course, that would lead to re-infection, but the percentage of failures in the adult dentition was very, very low. The cases were very carefully picked as to pain and other factors. The failures were higher in the primary dentition than they were in the adult. The highest percentage of failures was in the primary teeth where the pulp was exposed and they were capped; and I showed one of those cases this morning. I cannot tell you exactly what the percentage of failures was, but I feel safe in saying that in about 3,000 cases, they have been very, very low in the primary dentition, and almost none in the adult dentition. But it is going to take a lot more time to come out with a thorough report.

DR. BEECHEN: I am going to carry that question a little further by asking this. I presume that there were some cases that got away from you. In those cases where you have eventually picked them up a year or two later and in which you have *not* had an opportunity to remove the calcium hydroxide, have you ever seen an extension of caries?

DR. SOWDEN: No. For instance, in the Class I cavities that were treated in this manner, I have seen other cavities in the same tooth such as a Class II, but it was on the outer surface, away from the caries that had been recalcified.

DR. BEECHEN: Dr. Nacht, I have two questions for you. What is the exact nature of your devitalizing paste? Or what is the formula for the paste?

DR. NACHT: It is phenol, formalin creosote with the thymol as a liquid, barium sulfate, iodine, and paraformaldehyde in the powder. We use a proprietary or commercial preparation for this because we want everyone in the group to use exactly the same material and therefore, we decided to use this commercial drug product.

DR. BEECHEN: I think you have been using it for years, and if you want to mention it, I will take the blame for it.

DR. NACHT: We decided to use a preparation on the market for many years. It is called Oxy-para and is put out by Ransom and Randolph.

DR. BEECHEN: Well, that at least answers the question. There have been many papers written in which they have incorporated with their calcium hydroxide, various antibiotics, and it has been a rather controversial thing as to whether the presence of antibiotics in calcium hydroxide enhances the calcium hydroxide therapy or not. The next question is related to that: Would the incorporation of an antobiotic in the

calcium hydroxide increase the percentage of successful cases. If possible, give us an indication of any work with which you are familiar in which antibiotics have been incorporated.

DR. LAW: I think the incorporation of suitable antibiotics in the calcium hydroxide would probably be smart. One report was made on that but the cases were not followed long enough to feel that you could go by their results. You have to use an antibiotic that was not neutralized by the alkalinity of the calcium hydroxide, such as terramycin.

DR. RALPH MCDONALD: To carry on with that a little further, going along with Dr. Law, when penicillin is incorporated with calcium hydroxide in this moist alkaline media it is inactivated very quickly. Aureomycin and terramycin will maintain some activity for a period of time. However, there is a recent report that aureomycin will retard the proliferation of fibroblasts and in turn might interfere with healing. So I think that we should go at this very slowly but carefully in our use of the antibiotic until more clinical data are available.

DR. BEECHEN: Dr. Nacht, this is directed at you. If calcium hydroxide is successful, is it not preferable? Why not retain a vital pulpotomy technic? In other words, why not do a vital pulpotomy instead of a non-vital pulpotomy?

DR. NACHT: Well, I can answer that in a few words. In the very bad cases, the vital pulpotomy failed us.

DR. BEECHEN: Are you doing both vital and non-vital pulpotomies?

DR. NACHT: Yes, we are.

DR. LAW: The assumption is that the non-vital pulpotomy is non-vital, and it isn't, I think. The Rhesus monkey study that I referred to is relevant. No one proved the opposite. We thought that at first the formalin paste would pickle the pulp like a mummy that you dig out of the ground, but this is not true. In the old technic used years ago, they devitalized the tooth first with arsenic and put the other drugs on top. In this technic the tooth is anesthetized first, then excavated and amputated under anesthesia, and then the drug is placed. In the animal subject the pulp was not devitalized. The question is: Is it better to have a vital pulp than a non-vital pulp? In both cases I think the pulp is vital.

DR. BEECHEN: Well, I think that you and Max will have to get together and maybe change the title of his paper.

DR. NACHT: I would like to say that it is only in the last month that I have talked with Dave and he told me about this. I think this puts a new light on the subject.

DR. BEECHEN: Dr. Sowden, are you doing any other type of pulp therapy, or are you treating all possible exposures in the same manner?

DR. SOWDEN: No. I said this morning in the paper, it all depends on the clinical and radiographic evaluation of the case. It may be better in some cases to do a non-vital pulpotomy treatment. For instance, if the crown of a central were fractured, my belief would be to do a pulpotomy. I think there is one thing I would like to make a comment on that has not been brought out in the pulpal therapy discussion. I have noticed that in the period of a very long time in single-rooted teeth, calcium hydroxide vital pulpotomy was much more successful than in multi-rooted teeth; and in fact they mentioned this morning about the 40 and 50% success. I felt that I was getting around 35%. I do not think that there is any one technic that will fit all situations. That is one thing that I wanted to bring out very clearly. This is not a cure-all, but I think it has some

merit and those cases that we do in the office are certainly very carefully selected. But I am still doing therapeutic pulpotomies and calcium hydroxide vital pulpotomies.

DR. BEECHEN: Were anaerobic cultures made of the carious dentin after calcium hydroxide treatment?

DR. SOWDEN: Yes. We placed these teeth under a rubber dam and removed the caries with sterile spoons. Then we cultured this, performed the treatment, and in a week or two weeks' time removed the alloy and the calcium hydroxide with sterile spoons and went ahead and cultured it again. After three weeks' time the bacteria were nil. As a control I took some zinc oxide and water and placed that over the caries after I had made a culture. If I remember correctly, we had about 50 colonies and then I had the child back in two weeks and I took out the zinc oxide and water mixture over the caries with sterile spoons and then we made a culture again. Colonies were present. We placed calcium hydroxide on top of that and then sealed it and had the child back in one week. I found 15 colonies and I had the child back and cultured again and had no growth at all. That does not necessarily mean that there was not some growth there, and there may have been some deeper down. I have seen some other slides where the organisms have gotten down to the tubules below the caries.

DR. BEECHEN: *Question:* Is pulp testing of any value in selecting primary teeth for pulpotomy or in the evaluation of the success of the procedure?

DR. RALPH MCDONALD: I found that pulp testing, particularly the electric pulp test, to be of very little value in the selection of primary teeth for vital pulp therapy. First of all, I found that the child was quite apprehensive after you used it once, and then they gave a false reaction. Also in the histologic study, teeth that responded normally, were compared with teeth on the opposite side of the mouth. The one that responded normally, histologically demonstrated a rather advanced degenerative change, or at least inflammation so that in the case of primary teeth I feel we need methods other than the electric pulp test to help us select cases.

DR. BEECHEN: Dr. Law, you mentioned that the absence of a dentinal bridge does not necessarily indicate a failure. Is it not possible to have a failure with the presence of a dentinal bridge?

DR. LAW: Oh, yes. You can have one canal with a dentinal bridge and failure, and the other without a dentinal bridge and no failure. I definitely think that you have a pulp die under a dentinal bridge.

DR. SOWDEN: Just because you have this white area that I keep referring to in the x-ray, that does not mean that your case is a success. So do not misjudge and think that as long as you have a white area you are perfectly safe.

DR. BEECHEN: Dr. Nacht, just answer yes or no to this one. Does the absence of a permanent successor influence your treatment in pulp therapy?

DR. NACHT: No.

DR. BEECHEN: Ralph, I am going to let you start off with a little recapitulation—about a minute apiece.

DR. MCDONALD: I can only refer to the vital technic using calcium hydroxide. I think that if we use greater care in the selection of our cases that we can have greater success than has previously been reported. I cannot comment on the other technics that have been used because I have not had sufficient experience. I

think this has been a very valuable session for me, and I hope it has for you. I have learned a great deal this morning.

DR. LAW: Well, I see the whale is on the surface, but I think we can say this much: That the vital pulp therapy using calcium hydroxide has been presumed to be more successful than it actually is; and I think more studies are needed, and I think that we need to get more information on these other methods so that we can find out which is the best.

DR. NACHT: I think that Dr. McDonald hit the nail on the head when he said that choice of cases was a great determining factor, I think this is one of the things that forced us into doing this type of pulp therapy, and I think we need a lot more work on the choice of cases.

DR. SOWDEN: While I feel that all these things are important, I also feel that the technic must be selected for each individual case. There are cases where some of these things won't work. One method will not work on all conditions. I very definitely agree we need a whole lot more study on the subject.

Gingivitis and Vincent's Infection in Children

MARCU BRUCKER, D.D.S.*

EVER since Plaut[1] published his findings in 1894, and Vincent[2, 3, 4] made known the results of his studies in 1896, 1898, and 1899, the controversy regarding the etiology and diagnosis of Vincent's infection has not ceased. Among the generally accepted local predisposing causes are: poor oral hygiene, caries, erupting teeth, trauma and mechanical irritants, such as fillings with faulty contact points and margins, also imperfectly designed and constructed fixed and removable dental appliances. Chemical irritants produced by too much smoking and by the excessive consumption of alcoholic beverages are cited as possible additional local influences. Malnutrition, blood dyscrasias, endocrine disturbances, colds and other diseases which reduce the ability of the body to cope with infection are generally regarded as systemic predisposing factors.

However, the most important consideration is the exciting cause. This is of bacterial origin. The two microorganisms usually considered responsible are the Borrelia vincenti and the Bacillus fusiformis. Due to the fact that they are found living and acting together (in symbiotic relationship) the team name of fusospirochetal organisms or fusospirochetes is also applied to them. Vincent, a French physician, first demonstrated these bacteria in angina of the tonsillar and pharyngeal regions. It was he who first gave a concise but comprehensive description of the condition: hence the name Vincent's angina. Later the germs were isolated from the mouth and gingivae. In order to differentiate this form of the malady from that confined to the tonsillar and pharyngeal zones (which is usually accompanied by choking and spasms), the name Vincent's infection was adopted for the oral type.

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MICROSCOPIC DIAGNOSIS

The Smear

It is claimed that the microorganisms involved in Vincent's infection are found in normal, clean, and healthy mouths with no active caries as well as in dirty mouths with inflamed gums, unhealthy gingival or periodontal pockets, and carious teeth[5]. The presence of fusospirochetal organisms on a stained slide, therefore, it is stated, has little significance. This view, which has long been held, was recently re-emphasized by Miller[6], Glickman[7], Beube[8], and others. According to these writers the smear is not essential in diagnosis.

The general consensus seems to be that the clinical manifestations are the reliable criteria in making a correct diagnosis. The clinical picture of the acute form of the disease, it is pointed out, is characteristic. High temperature (sometimes reaching 103°), general malaise, poor appetite, bleeding, inflamed and painful gums, and excessive salivation are unmistakable signs of its presence. These symptoms, it is said, are so easily recognized that microscopic verification is unnecessary. The same applies to the chronic type of the infection. Smears are

TABLE I

Incidence of gingivitis in the total number of children investigated (ages 5 to 16 years inclusive)

	White Boys	White Girls	Negro Boys	Negro Girls	Total
Number of children examined	4633	4330	2726	2915	14,604
Number of children with gingivitis	614	496	212	170	1,492
Number of children with very slight gingivitis	72	54	8	2	136
Number of children with slight gingivitis	315	264	125	103	807
Number of children with moderate gingivitis	91	67	31	28	217
Number of children with severe gingivitis	136	111	48	37	332
Per cent of children with gingivitis	13%	11.5%	8%	6%	10%

regarded as useless for diagnostic purposes even though these cases—mostly met in private practice—can easily be confused with other forms of gingival disorders.

The Present Study

Source of Material

In view of the claims just cited and in order to evaluate the importance of the bacteriological smear in the diagnosis and treatment of Vincent's infection this study was undertaken. A group of 14,604 white and Negro children of both sexes representing 14 nationalities was thoroughly investigated. Their ages ranged from 5 to 16 years inclusive. Their socio-economic levels varied widely. Of those studied, 7,359 were boys (white, 4,633; Negro, 2,726). The balance of 7,245 were girls (white, 4,330; Negro, 2,915). Some lived in exclusive sections of the city with country atmosphere and surroundings, beautiful homes, adequate diet and the best parental care. Others inhabited average city districts with comfortable homes and with good general care. Still others lived in the downtown sections of the city where housing accommodations and other conditions were not always satisfactory.

As Vincent's infection is primarily a disease of the gums, usually (though not always) beginning as a form of gingivitis, it was decided at first to confine this study to children with gingival disorders. A group with apparently normal gums was later included. No cases were selected. All were discovered during a routine dental survey as the children reported in regular manner with other members of their classes.

Method of Examination and Study

The classification of children with gingivitis was based on a most careful visual examination. The mouth mirror, explorer, college pliers, scalers, cotton pellets, and cotton rolls were used in the procedures. In order to estimate the incidence of Vincent's infection and its relationship to gingival abnormalities, the children investigated were divided into five groups: (1) those with normal gums, (2) those with very slight gingivitis, (3) those with slight gingivitis, (4) those with moderate gingivitis, and (5) those with severe gingivitis.

The term "normal" denotes gingivae with typically good stippling and perfect embrasure of the necks of the teeth and with the gingival crests showing normal outline and contouring. Their color was a healthy pink. There were no areas of in-

flammation, no bleeding on pressure with a cotton roll and no history of bleeding on brushing.

"Very slight gingivitis" indicates a minute departure from the normal. The marginal gingivae and the interdental papillae disclosed a thin reddish line—as if traced with a pencil—but the normal marginal contour was preserved. There was no bleeding on pressure with a cotton roll and rarely any bleeding on brushing. No typical clinical signs of Vincent's infection were noted.

"Slight gingivitis" implies a more marked deviation from the normal with zones of incipient inflammation; slight blunting of the gingival margins and of the crests of the interproximal papillae and a very slight reduction in height. The gingivae were light red with hardly any detachment from the tooth surface. There was faint bleeding on slight pressure with a cotton roll and some of the children studied stated that there was occasional bleeding on brushing. Clinically, no typical symptoms of Vincent's infection were manifested.

"Moderate gingivitis" indicates rather pronounced flattening or rounding of the marginal gingivae and excessive blunting of the crests of the papillae. The gingival color was bright red. There was loss of marginal contour with detachment from the tooth surface and edematous "puffiness" of the entire gingivae. Glazing of the gingival tissue was generally present. Bleeding was easily induced by slight pressure with a cotton roll and more than occasional bleeding on brushing with pain on chewing was at times reported.

"Severe gingivitis" signifies marked loss of contour with pronounced recession of the gums exposing the necks of the teeth. Serious tissue damage to the marginal gingivae and crests of the interproximal papillae was evident. There was pocket formation often involving the attached gingivae. Excessive "puffiness" of the interproximal papillae and not infrequently of the entire gingivae was prevalent. Gingival sloughing and ulceration were also encountered. Dark purplish-red gingivae were generally noted. There was tenderness and pain on brushing. Bleeding was spontaneous and there was complaint of discomfort on chewing and even between meals by many of this group. Fetor oris was practically universal. All children in this group showed clinical symptoms and oral characteristics of Vincent's infection.

TABLE II

Age distribution in the white and Negro children studied for incidence of Vincent's infection

Ages at Last Birthday	White Boys	White Girls	Negro Boys	Negro Girls	All Groups Combined
5	22	23	25	25	95
6	41	33	35	34	143
7	48	41	30	28	147
8	64	58	29	35	187
9	94	60	45	43	242
10	95	100	43	55	293
11	124	114	78	68	384
12	152	139	62	70	423
13	174	132	56	45	407
14	66	38	35	17	156
15	21	10	12	11	54
16	5	3	0	3	11
Total...	906	751	450	435	2542

Bacteriology

Smears for microscopic examination were obtained from the depths of zones which suggested possible incubation. Such zones included some or all interproximal papillae, or involved, partially or completely, the labial or buccal gingivae. The palatal and lingual gingivae were less often affected but were similarly examined by obtaining smears from them. Where gingival or periodontal pockets

were present, smears were secured from the bottom of the pockets, care being exercised to avoid bleeding and contamination of the exudate. The pericoronal flaps of partly erupted teeth and gingival areas irritated by fillings with faulty contact points and margins or by incorrectly designed or constructed dental appliances were also given attention. Wherever possible (as in the majority of cases) smears were obtained from beneath the free margins of the gums. Every suspicious spot of oral irritation was investigated bacteriologically.

Before going further it is important to emphasize that fusospirochetal organisms may develop on the free mucous surface of the gums at the marginal gingivae and the outer portion of the interproximal crests of the papillae. This was demonstrated in the case of children with apparently healthy mouths and perfect gums where submarginal access for taking of smears was impossible and who were found positive for Vincent's infection. Hardgrove[9] states that the more virulent the organism the more likely it is to act on a free surface.

Laboratory Technic and Interpretation. The smears were fixed by passing the slides (smear-side up) over a flame two or three times, then flooded with crystal (gentian) violet, followed by washing with running water and drying. They next were meticulously examined by fully qualified bacteriologists using a $\frac{1}{12}$ inch oil-immersion lens.

Specimens were declared "negative" in the absence of Borrelia vincenti (Vincent's spirochetes) and Fusiformis dentium (Bacillus fusiformis). Those with an occasional spirochete unaccompanied by fusiform bacilli were also declared negative. Specimens were judged "positive" when both Borrelia vincenti (Vincent's spirochetes) and Fusiformis dentium (Bacillus fusiformis) were in close proximity constituting a fusospirochetal mixture.

Analysis of Findings

Of the total number of 2585 smears taken, 300 were positive (11.6%). The Negro boys and girls revealed a much greater incidence of positive smears than the white children (male and female). The percentage of white girls with positive smears exceeded that of the white boys (girls, 7.2%; boys, 5.8%). In the case of the Negro children the reverse was true: the boys showed a higher incidence than the girls (boys, 15%; girls, 12%).

Regional Involvement

Table III and IV show the regions affected with various degrees of gingivitis in the 815 boys and in the 717 girls studied for such involvement. A careful analysis of the accumulated data will show that in all groups the entire upper and lower regions were most frequently involved. The upper anterior region, the lower anterior region, and both upper and lower anterior regions were affected in the order named. In view of these findings the point must be made that no particular section can be utilized as an index of the condition of the whole gingival area. Each case must be considered separately if assumptions and inaccuracies are to be avoided. As far as can be judged from this study, the use of a gingivitis index[10] (based on the examination of the anterior segments of the gingivae only) may lead to erroneous conclusions as to regions mostly diseased, as to the degree of gingival irritation, as well as to the incidence of gingivitis. There is much to consider in Marshall-Day's[11] conclusion that there is danger in utilizing one area of the mouth as an index of the state of the entire gingivae.

TABLE III

*Regions affected with various degrees of gingivitis and incidence of positive smears in these regions in white and Negro boys (ages 5 to 16 years inclusive)**

Total Number of Boys Studied	With Normal Gums (no region) (affected)		With Very Slight Gingivitis		With Slight Gingivitis		With Moderate Gingivitis		With Severe Gingivitis		Grand Total		Combined Grand Total
White, 499 Negro, 316	176 121		8 7		213 118		42 29		60 41		499 316		815
	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	
Number of smears taken in them	13 *14*	163 *107*	1 *2*	7 *5*	13 *22*	200 *96*	1 *9*	41 *20*	8 *16*	52 *25*	36 *63*	463 *253*	499 *316*
No. with entire upper region affected					*1*	11 *6*		4 *2*		3	0 *1*	18 *8*	18 *9*
No. with entire lower region affected						5					0 *0*	5 *0*	5 *0*
No. with upper anterior region affected				5 *2*	2 *3*	72 *23*	*1*	13 *4*		6 *1*	2 *4*	96 *30*	98 *34*
No. with lower anterior region affected				*3*	3 *5*	27 *29*	*4*	6 *6*	*3*	3 *3*	3 *12*	36 *41*	39 *53*
No. with upper and lower anterior region affected					2 *6*	32 *15*	1	4 *3*	2 *3*	5 *5*	5 *9*	41 *23*	46 *32*
No. with entire upper and lower regions affected			1 *2*	2	5 *6*	47 *20*	*3*	11 *5*	6 *8*	35 *14*	12 *19*	95 *39*	107 *58*
No. with upper right posterior region affected					*1*	*1*					0 *1*	0 *1*	0 *2*
No. with upper left posterior region affected					1	5 *1*		3	*1*	*2*	1 *1*	8 *3*	9 *4*
No. with lower right posterior region affected													
No. with lower left posterior region affected						*1*					*0*	*1*	*1*
No. with upper and lower right and left posterior regions affected							*1*				*1*	*0*	*1*
No. with upper and lower right and left molar regions affected									*1*		*1*	*0*	*1*
No. with upper right and left molar regions affected						1					0	1	1

* The upper figure in each block refers to white children, the lower (italicized) figure to Negro children.

TABLE IV

*Regions affected with various degrees of gingivitis and incidence of positive smears in these regions in white and Negro girls (ages 5 to 16 years inclusive)**

Total number of girls Studied	With Normal Gums (no region) (affected)		With Very Slight Gingivitis		With Slight Gingivitis		With Moderate Gingivitis		With Severe Gingivitis		Grand Total		Combined Grand Total
White 423 Negro 294	150 136		5 1		178 101		35 24		55 32		423 294		717
	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	
Number of smears taken in them	9 *19*	141 *117*	1 *0*	4 *1*	17 *20*	161 *81*	4 *4*	31 *20*	11 *8*	44 *24*	42 *51*	381 *243*	423 *294*
No. with entire upper region affected			0	0	3	7 *5*		1	2	4 *2*	5 *0*	12 *7*	17 *7*
No. with entire lower region affected						1		1 *1*		1 *1*	0 *0*	3 *2*	3 *2*
No. with upper anterior region affected			1	3 *1*	4 *4*	61 *16*		8 *5*		2 *4*	5 *4*	74 *26*	79 *30*
No. with lower anterior region affected				1	2 *8*	14 *22*	1 *1*	3 *5*	1 *2*	2 *2*	4 *11*	20 *29*	24 *40*
No. with upper and lower anterior region affected					2 *4*	25 *15*	2 *3*	6 *3*	1	4 *4*	5 7	35 *22*	40 *29*
No. with entire upper and lower regions affected					5 *2*	47 *19*	1	10 *6*	6 *6*	28 *10*	12 *8*	85 *35*	97 *43*
No. with upper right posterior region affected					1 *1*	1 *1*				1 *1*	1 *1*	1 *2*	2 *3*
No. with upper left posterior region affected					*1*	4 *2*		1		2	0 *1*	7 *2*	7 *3*
No. with lower right posterior region affected													
No. with lower left posterior region affected													
No. with upper and lower right and left posterior regions affected													
No. with upper and lower right and left molar regions affected						1 *1*		1	1	1	1 *0*	3 *1*	4 *1*
No. with upper right and left molar regions affected													

* The upper figure in each block refers to white children, the lower (italicized) figure to Negro children.

TABLE V

*Regions affected with various degrees of gingivitis at different ages and incidence of positive smears in these regions at each age in 815 white and Negro boys**

Ages at Last Birthday	No. of Children Studied	No. of Smears Taken in Them	No. with Normal Gums (no region affected)	No. of Positive Smears in Them	No. with Entire Upper Region Affected	No. of Positive Smears in Them	No. with Entire Lower Region Affected	No. of Positive Smears in Them	No. with Upper Anterior Region Affected	No. of Positive Smears in Them	No. with Lower Anterior Region Affected	No. of Positive Smears in Them	No. with Upper and Lower Anterior Regions Affected	No. of Positive Smears in Them	No. with Entire Upper and Lower Regions Affected	No. of Positive Smears in Them	No. with Upper Right Posterior Region Affected	No. of Positive Smears in Them	No. with Upper Left Posterior Region Affected	No. of Positive Smears in Them	No. with Lower Right Posterior Region Affected	No. of Positive Smears in Them	No. with Lower Left Posterior Region Affected	No. of Positive Smears in Them	No. with Upper Right and Lower Left Posterior Regions Affected	No. of Positive Smears in Them	No. with Upper Right and Lower Left Molar Regions Affected	No. of Positive Smears in Them	No. with Upper Right and Left Molar Regions Affected	No. of Positive Smears in Them	Total No. with Positive Smears
5	10 8	10 8	9 8	1 1																												1 1
6	20 20	20 20	18 18	1 2	1 1				1 1	0 0					1 1	0 0																1 3
7	14 15	14 15	10 10	1 2					2 2	0 0	1 2	0 0			2 2	0 0																2 2
8	29 14	29 14	12 7	1 2	1 1	0 0			7 2	0 0	4 1	0 0			4 3	0 1	1 0	0 0							1 1	1 1						1 4
9	51 32	51 32	16 6	2 1	1 1	0 0			15 9	0 0	5 2	0 0			10 0	1 1	1 0	0 0														3 7
10	51 30	51 30	14 7	1 2	6 6	0 0			9 5	0 0	1 1	0 0	0 0	0 0	12 10	2 4	1 0	0 0														3 3
11	67 61	67 61	17 29	3 1					16 7	0 0	8 11	1 3	5 3	0 0	18 11	0 2	1 0	0 0														4 7
12	97 51	97 51	21 18	2 1	4 2	0 0	1 0	0 0	22 3	1 1	13 11	1 2	15 8	1 4	18 7	3 1	3 1	0 0	1 1	0 0												9 13
13	105 43	105 43	41 12	1 1	5 3	0 0	4 1	0 0	17 2	0 0	4 0	0 0	7 0	3 3	27 9	4 2	3 1	1 0														8 7
14	40 33	40 33	12 5	0 1	1 2	0 0			7 2	0 0	2 3	1 2	5 7	0 0	11 8	0 4	1 0	0 0													1	0	1 7
15	13 10	13 10	6 1	0 0					2 1	0 0	3 0	1 0	1 1	1 0	4 3	1 2																2 4
16	2 0	2 0							1	0					1	1																1 0
	499 316	499 316	176 181	13 14	18 9	0 1	5 0	0 0	98 34	2 4	39 53	3 12	46 32	5 9	107 58	12 19	8	1 1							1	0	1	1	1	1	1	36 63
	815	815	267	27	27	1	5	0	132	6	92	15	78	14	165	31	2	2	1	13					1	0	1	1	1	1	0	99

* The upper figure in each block refers to white children, the lower (italicized) to Negro children.

TABLE VI

*Regions affected with various degrees of gingivitis at different ages and incidence of positive smears in these regions at each age in 717 white and Negro girls**

Ages at Last Birthday	No. of Children Studied	No. of Smears Taken in Them	No. with Normal Gums (no region affected)	No. of Positive Smears in Them	No. with Entire Upper Region Affected	No. of Positive Smears in Them	No. with Entire Lower Region Affected	No. of Positive Smears in Them	No. with Upper Anterior Region Affected	No. of Positive Smears in Them	No. with Lower Anterior Region Affected	No. of Positive Smears in Them	No. with Upper and Lower Anterior Regions Affected	No. of Positive Smears in Them	No. with Entire Upper and Lower Regions Affected	No. of Positive Smears in Them	No. with Upper Right Posterior Region Affected	No. of Positive Smears in Them	No. with Upper Left Posterior Region Affected	No. of Positive Smears in Them	No. with Lower Right Posterior Region Affected	No. of Positive Smears in Them	No. with Lower Left Posterior Region Affected	No. of Positive Smears in Them	No. with Upper and Lower Right and Left Posterior Regions Affected	No. of Positive Smears in Them	No. with Upper and Lower Right and Left Molar Regions Affected	No. of Positive Smears in Them	No. with UpperRight and Left Molar Regions Affected	No. of Positive Smears in Them	Total No. with Positive Smears
5	10 7	10 7	7 6	1 3																											1 3
6	15 15	15 15	13 15	0 2			1	0																							0 21
7	15 12	15 12	7 8	1 2	1	0	2	0			1 2	0 1																			1 3
8	34 21	34 21	13 14	1 2			8 1				4 0	0 1	3 0	0 2																	1 2
9	36 29	36 29	9 12	1 6	3	0	7 3				2 0	1 2	5 2	1 0	11 6	3 1															8 8
10	53 34	53 34	9 11	0 0	1	0	10 9	0 0	6 2	1 1	6 4	0 0	17 3	1 1			1	0 1									1	0			3 3
11	66 53	66 53	15 23	0 2	3	0	21 5	1 0	4 5	0 0	5 3	1 2	15 12	2 1													3	1			5 5
12	78 60	78 60	31 27	3 3	2 2	1 0	15 6	0 1	2 5	0 2	9 3	3 1	17 4	3 1	2 2	0 0															10 9
13	85 39	85 39	37 9	2 0	6 2	3 0	10 4	2 3	4 7	1 3	9 2	0 1	10 6	3 2																	11 9
14	23 14	23 14	0 0	4 6	2	1	4	0	2 3	1 1	2 2	0 2	8 3	0 1			1	0													2 4
15	7 9	7 9	1	0	1	0	1 1	0 1	1	1	1	1	5 2	0 1			1	0													0 3
16	2 3	2 3	1	0	1	0			1 0	0 1	1	0																			0 0
	423 294	423 294	150 156	9 19	17 7	5 0	3 2	0 0	79 30	5 4	24 40	4 11	40 29	5 7	97 43	12 8	2 3	1 1	7 3	0 1							4 1	1 0			42 61
	717	717	286	28	24	5	5	0	109	9	64	15	69	12	140	20	5	2	10	1							5	1			93

* The upper figure in each block refers to white children, the lower (italicized) to Negro children.

TABLE VII

*Incidence of positive smears in white and Negro boys with normal gums and with various degrees of gingivitis according to age**

Ages at Last Birthday	No. of Children Studied	No. of Smears Taken in Them	No. of Children & Normal Gums (no region affected)	No. of Positive Smears in Them	No. of Children & Very Slight Gingivitis	No. of Positive Smears in Them	No. of Children & Slight Gingivitis	No. of Positive Smears in Them	No. of Children & Moderate Gingivitis	No. of Positive Smears in Them	No. of Children & Severe Gingivitis	No. of Positive Smears in Them	Total No. Positive
5	14	14	12	1			1	0	1	0			1
	8	*8*	*8*	*1*									*1*
6	30	30	25	1	3	0	2	0					1
	20	*20*	*18*	*2*			*2*	*1*					*3*
7	41	41	26	3	3	0	6	2	3	0	3	0	5
	15	*15*	*10*	*2*	*1*	*0*	*3*	*0*	*1*	*0*			*2*
8	58	58	19	1	8	0	23	1	4	1	4	0	3
	17	*17*	*7*	*2*	*1*	*1*	*6*	*1*	*2*	*1*	*1*	*0*	*5*
9	94	94	24	2	12	0	42	1	9	0	7	0	3
	34	*34*	*6*	*1*			*21*	*5*	*4*	*1*	*3*	*0*	*7*
10	92	97	22	1	8	0	42	2	10	0	16	1	4
	31	*31*	*7*	*2*	*1*	*1*	*18*	*3*	*2*	*1*	*3*	*2*	*9*
11	121	129	27	3	17	0	47	1	14	0	24	1	5
	63	*63*	*30*	*1*	*2*	*1*	*17*	*3*	*6*	*1*	*8*	*2*	*8*
12	149	149	27	3	11	2	64	5	18	0	29	4	14
	52	*52*	*18*	*1*	*1*	*0*	*18*	*5*	*6*	*2*	*9*	*4*	*12*
13	170	173	50	1	8	0	61	2	22	3	32	6	12
	47	*47*	*12*	*1*	*1*	*0*	*18*	*2*	*2*	*0*	*14*	*5*	*8*
14	65	67	15	0	5	0	21	1	8	0	18	0	1
	35	*35*	*5*	*1*	*1*	*0*	*17*	*3*	*6*	*1*	*6*	*2*	*7*
15	21	22	8	0	1	0	4	1	2	1	7	0	2
	12	*12*	*1*	*0*			*5*	*0*	*2*	*2*	*4*	*2*	*4*
16	5	5			1	0	2	0	1	0	1	1	1
	0	*0*											
Total	860	879	254	16	77	2	315	16	92	5	141	13	52
	334	*334*	*122*	*14*	*8*	*3*	*125*	*23*	*31*	*9*	*48*	*17*	*66*
Grand total	1194	1213	376	30	85	5	440	39	123	14	189	30	118

* The upper figure in each block refers to white children, the lower (italicized) to Negro children.

TABLE VIII

*Incidence of positive smears in white and Negro girls with normal gums and with various degrees of gingivitis according to age**

Ages at Last Birthday	No. of Children Studied	No. of Smears Taken in Them	No. of Children ℰ Normal Gums (no region affected)	No. of Positive Smears in Them	No. of Children ℰ Very Slight Gingivitis	No. of Positive Smears in Them	No. of Children ℰ Slight Gingivitis	No. of Positive Smears in Them	No. of Children ℰ Moderate Gingivitis	No. of Positive Smears in Them	No. of Children ℰ Severe Gingivitis	No. of Positive Smears in Them	Total No. Positive
5	12	12	10	1			2	0					1
	7	*7*	*7*	*3*									*3*
6	26	26	22	0	1	0	3	0					0
	15	*15*	*15*	*2*									*2*
7	37	38	20	1	8	0	8	0	2	0			1
	12	*12*	*8*	*2*			*4*	*1*					*3*
8	54	54	17	2	2	0	30	1	2	0	3	1	4
	21	*21*	*14*	*2*			*5*	*0*	*2*	*0*			*2*
9	58	58	15	2	4	0	27	8	6	0	6	1	11
	29	*29*	*12*	*5*			*15*	*3*			*2*	*0*	*8*
10	97	100	13	0	14	1	34	1	10	1	29	3	6
	38	*38*	*13*	*0*	*1*	*0*	*15*	*3*	*8*	*0*	*1*	*0*	*3*
11	110	116	28	1	12	1	50	3	11	0	15	1	6
	58	*58*	*28*	*2*			*20*	*1*	*6*	*1*	*4*	*1*	*5*
12	135	145	46	3	10	0	58	3	15	2	16	3	11
	62	*62*	*27*	*3*			*20*	*4*	*6*	*1*	*9*	*2*	*10*
13	128	131	39	2	7	0	34	3	19	1	32	6	12
	36	*36*	*9*	*0*	*1*	*0*	*12*	*5*	*4*	*1*	*10*	*4*	*10*
14	37	38	7	0	1	0	18	2	5	1	7	0	3
	17	*17*	*5*	*0*			*5*	*2*	*2*	*1*	*5*	*2*	*5*
15	10	10	3	0			3	0			4	1	1
	11	*11*	*1*	*0*			*6*	*2*			*4*	*1*	*3*
16	3	3					1	0			2	0	0
	3	*3*					*1*	*0*			*2*	*0*	*0*
Total	707	731	220	12	59	2	268	21	70	5	114	16	56
	309	*309*	*139*	*19*	*2*	*0*	*103*	*21*	*28*	*4*	*37*	*10*	*54*
Grand total	1016	1040	359	31	61	2	371	42	98	9	151	26	110

* The upper figure in each block refers to white children, the lower (italicized) figure to Negro children.

One of the facts emphasized by this study is that among the white and Negro boys (Table III), and also the white girls (Table IV), the largest number of positive smears was furnished by those with gingivitis of the entire upper and lower regions. In the Negro girls, however, a preponderance of positive smears was obtained from those with gingivitis of the lower anterior region (Table IV). The posterior regions, both upper and lower, in both white and Negro children were found least affected with gingivitis. These zones furnished the smallest number of positive smears. This, however, does not imply that their condition need not be ascertained. Failure to do so would be a disregard of detail and a serious omission.

Age and Regional Involvement

Tables V and VI illustrate the incidence of positive smears in the various regions affected with gingivitis at different ages. If the involved zones are considered separately it becomes evident that no increase in the incidence of positive smears occured with an advance in age regardless of the region involved and the type of gingivitis encountered.

It may be noted here that the white and Negro boys (Table V) and also the white girls (Table VI) supplied the largest number of positive smears at age 12 (all regions combined). In the case of the Negro girls, those in the 12- and 13-year age groups were more frequently affected (all regions combined) (Table VI). It is difficult to explain this, but it may be said that healthy gingival tissue is dependent on normal endocrine function. At or about the age of puberty, due to certain endocrine adjustments within the body, dysfunctions of these glands (hypo- or hyper-) occasionally occur. Such dysfunctions affect the general metabolism and influence the development of gingival and periodontal disorders. However, no definite conclusion on this issue can be drawn with regard to the subjects involved in the present study as none underwent tests of endocrine function.

Degrees of Gingivitis and Age

If the various types of gingivitis are considered separately it will be noted that there was practically no increase, in any of the children studied, in the incidence of positive smears as they grew older, regardless of the degree of severity of gingivitis. (Tables VII, VIII). In the white and Negro boys in the 12-year age group (with severe gingivitis) there was a somewhat higher incidence of positive smears than in the boys in the other divisions (Table VII). An important fact is that the white girls in the 9-year age group and the Negro girls in the 13-year age group (with slight gingivitis) showed a preponderance of positive smears over the girls in the other divisions. A vital point is that the white boys and girls, and also the Negro boys with normal gums, disclosed no definite trend toward a higher prevalence of the disease as they became older. We must emphasize that the Negro girls in the 9-year age group furnished the highest percentage of positive smears among those with normal gums.

This is mentioned to show that age—regardless of whatever influence, (that of an endocrine nature excepted)—and gingival manifestations (regardless of degree of severity) are inconsistent factors. They cannot be definitely related to the incidence of Vincent's infection.

Caries and Vincent's Infection

Apparently the claim that one of the local predisposing causes of Vincent's infection is caries is valid. In connection

TABLE IX

Caries and Vincent's infection: incidence of positive smears in white and Negro children with and without dental caries

	White			Negro			Grand Total
	Boys	Girls	Total	Boys	Girls	Total	
No. of children studied.....	860	707	1567	334	309	643	2210
No. of children with no dental caries.....	315	272	587	134	150	284	871
No. of smears taken in them.....	315	272	587	134	150	284	871
No. with positive smears...	19	18	37	22	24	46	83
Per cent with positive smears.....	6%	6.6%	6.3%	16%	16%	16%	9.5%
No. of children with dental caries.....	545	435	980	200	159	359	1339
No. of cavities present in them.....	2169	1759	3928	686	541	1227	5155
No. of smears taken in them.....	545	435	980	200	159	359	1339
No. with positive smears...	33	38	71	44	30	74	145
Per cent with positive smears.....	6%	8.7%	7%	22%	18.8%	20%	10%

with this, however, attention is called to Table IX. A careful analysis clearly brings out that the 871 children free from active caries and the 1339 children with caries showed an almost equal percentage affected with the disease. Worthy of particular attention is the fact that the Negro boys and girls (with or without active caries) gave considerably higher percentages of positive smears than did the white children (male and female). A possible explanation for this may be an apparent inherent susceptibility to this infection. Additional studies on this phase of the subject are being carried out.

As shown in Table IX the Negro children with caries revealed higher percentages of positive smears than those free from active caries. Disregarding casual impressions it must be concluded that the higher caries incidence in the first mentioned group was not responsible for the greater prevalence of Vincent's infection. The main thing to keep constantly in mind is that the number of children with this disease was considerably smaller than that of those with dental caries. This would disprove any direct relationship between the two disorders.

Oral Hygiene and Vincent's Infection

In order to ascertain the relationship of oral hygiene to the incidence of Vincent's infection, the children studied were divided into 3 groups: first, those with "clean" teeth; second, those with "fairly clean" teeth, and third, those with "dirty" teeth. The term "clean" teeth implies an absence of food-particles, stain, and calculus from their surfaces; "fairly clean" teeth denotes food-particles and stains on some of the teeth; "dirty" teeth signifies the presence of heavy stain and abundant food debris on all teeth and on all of their surfaces. Calculus was noted in only a few isolated cases. It is not often seen in children.

TABLE X

*Oral hygiene and Vincent's infection. Incidence of positive smears in white and Negro children (ages 5 to 16 inclusive)**

Ages at Last Birthday	No. of Children Studied	No. of Smears Taken in Them	No. with Clean Teeth	No. of Positive Smears in Them	No. with Fair Teeth	No. of Positive Smears in Them	No. with Dirty Teeth	No. of Positive Smears in Them	Total No. Positive
Boys									
5–8	143	143	88	7	50	3	5	0	10
	60	*60*	*50*	*8*	*10*	*3*	*0*	*0*	*11*
9–12	456	456	163	10	246	14	47	2	26
	180	*180*	*71*	*14*	*94*	*19*	*15*	*3*	*36*
13–16	261	261	91	2	135	9	35	5	16
	94	*94*	*35*	*7*	*39*	*7*	*20*	*5*	*19*
Total	860	860	342	19(5.5%)	431	26(6%)	87	7(8%)	52(6%)
	334	*334*	*156*	*29(18%)*	*143*	*29(20%)*	*35*	*8(22%)*	*66(19%)*
Grand total	1194	1194	498	48(9.6%)	574	55(9.5%)	122	15(12.3%)	118(9%)
Girls									
5–8	129	129	83	5	44	0	2	1	6
	55	*55*	*43*	*9*	*11*	*1*	*1*	*0*	*10*
9–12	400	400	170	15	207	17	23	2	34
	187	*187*	*115*	*17*	*65*	*8*	*7*	*1*	*26*
13–16	178	178	82	7	76	5	20	4	16
	67	*67*	*34*	*6*	*28*	*11*	*5*	*1*	*18*
Total	707	707	335	27(7.8%)	327	22(6.72%)	45	7(15%)	56(7.9%)
	309	*309*	*192*	*32(16%)*	*104*	*20(19%)*	*13*	*2(15%)*	*54(17.5%)*
Grand total	1016	1016	527	59(11%)	431	42(9.7%)	58	9(15.5%)	110(10%)

* The upper figure in each block refers to white children, the lower (italicized) figure to Negro children.

Table X demonstrates that in the white boys and girls and also in the Negro boys those with dirty teeth gave the highest percentage of positive smears. In the Negro girls, however, the percentage of positive smears was higher in those with "fairly clean" teeth. If the age factor is considered, it will be noted that in the white boys no increase in the incidence of positive smears was manifested with an advance in years, regardless of the state of the teeth. The white girls furnished a blurred picture of upward and downward trends. Increased percentages of positive smears were supplied by the Negro boys with "clean" teeth and by those with "dirty" teeth in the older age divisions. The Negro girls with "fairly clean" teeth and those with "dirty" teeth similarly provided greater percentages as they reached higher age brackets. At all ages, in practically every group the incidence of positive smears was strikingly higher in all Negro children.

Their increased susceptibility to Vincent's infection was reaffirmed. Race with its many peculiarities may possibly render their body-defenses less able to evade or cope with Vincent's organisms.

Sifting rigorously the data obtained and the conditions observed, the conclusion can be reached that despite uneven trends here and there the children with "dirty" teeth showed a more pronounced tendency to harbor this infection. There are good grounds for the opinion that poor oral hygiene with its accumulation of food debris and the formation of incubation zones aided by excessive moisture and a lack of oxygen may favor the entrance and multiplication of fusospirochetal organisms.

Social Status and Vincent's Infection

Social status seems to play no definite part in the incidence of Vincent's infection (Table XI). For example, the children comprising Group No. 1 came from prosperous homes, with adequate medical and dental care and probably with high

TABLE XI

*Social status and Vincent's infection. Incidence of positive smears in white and Negro children (all ages combined)**

	White and Negro Boys				White and Negro Girls			
	No. of children studied	No. of smears taken	No. with positive smears	Per cent with positive smears	No. of children studied	No. of smears taken	No. with positive smears	Per cent with positive smears
Group No. 1[a]	480 *11*	499 *11*	19 *2*	3.9 *18*	405 *13*	429 *13*	19 *2*	4.69 *15*
Group No. 2[b]	98 *20*	98 *20*	11 *4*	11.2 *20*	71 *17*	71 *17*	12 *1*	16.9 *5.88*
Group No. 3[c]	238 *92*	238 *92*	20 *24*	8.4 *26*	187 *79*	187 *79*	17 *16*	9 *20*
Group No. 4[d]	10 *205*	10 *205*	1 *35*	10 *17*	7 *187*	7 *187*	1 *30*	14 *16*
Group No. 5[e]	34 *6*	34 *6*	1 *1*	2.9 *16*	24 *5*	24 *5*	3 *1*	12.5 *20*
Group No. 6[f]	All girls				13 *8*	13 *8*	4 *4*	30 *50*
Total	860 *334*	879 *334*	52 *66*	5.9 *19.7*	707 *309*	731 *309*	56 *54*	7.6 *17.4*
Grand total	1194	1213	118	9.7	1016	1040	110	10

* The upper figure in each block refers to white children, the lower (italicized) figure to Negro children.

[a] Children of a higher economic stratum.
[b] Children of a middle economic stratum.
[c] Children of a low economic level.
[d] Children of a very low economic level.
[e] Group of sickly individuals (mixed social strata).
[f] "Problem" children (mixed social strata).

standards of nutrition and good habits of oral hygiene. The white children in this division showed a low incidence of positive smears. There was a substantial increase in such incidence in the white boys and girls and in the Negro boys comprising Group No. 2 (with a lower standard of living). The Negro girls, however, furnished a lower percentage of positive smears than the Negro girls in Group No. 1. The white children in Group No. 3 and 4 belonged to a lower socio-economic level than those in Group No. 2, yet they gave a smaller percentage of positive smears than those in that group. That social status is not a factor in the incidence of Vincent's infection was further demonstrated by the Negro boys and girls in Group No. 4 who showed lower percentages of positive smears than those in Group No. 3. On the whole, the general picture presented by these four groups was uneven and inconsistent.

The children in Group No. 5 were mostly undernourished and frail looking. A few had arrested tuberculosis and some were asthmatic. Yet the white boys in this group supplied the lowest percentage of Vincent's infection. The white girls and the Negro boys and girls furnished percentages comparable with those in healthy groups. Such disclosures tend to render conclusions difficult. That systemic diseases and malnutrition may be contributory factors in gum disorders is a theory often advanced. My previous studies support this contention. I believe, however, that respiratory disease (such as asthma and tuberculosis) must be excluded from the list of systemic predisposing influences. Proof of this was supplied by my previous investigations on the subject. As regards dietary deficiencies it seems that malnutrition does not contribute to a reduction in gingival tissue resistance to this infection.

There were no boys in Group No. 6, but in this division both white and Negro girls showed a substantial percentage of positive smears. It should be emphasized that this group comprised children of low mentality. This is not meant to suggest that intelligence plays a part in the occurence of Vincent's infection. However, I have noticed in such groups a greater tendency toward a lax observance of oral hygiene and inattention to dental needs. Intelligence guides our habits and inclinations.

It might be stretching a point to reemphasize that social status and standards of living seemed of no consequence in the case of the white girls. The number with positive smears in each of their groups surpassed that of the white boys. The trend was indefinite in the Negro children, the boys giving a preponderance of positive smears in some groups, the girls in others. The influence of sex in immunity to this disease appeared uneven and confusing. Significantly the Negro boys and girls (with the exception of the girls in Group No. 2) revealed a higher incidence of positive smears than the white children (male and female). This again supplies a commentary on racial susceptibility to this disease. All people are not equally equipped physically to resist infection.

Owing to the small number of subjects in some of the groups conclusions must be drawn judiciously.

Summary and Discussion

The incidence of Vincent's infection in a group of 2542 white and Negro children of both sexes is reported. Fourteen hundred and ninety-two of those studied had some degree of gingivitis; the balance of 1050 had normal gums. The children with gingivitis represented the total number with gingival disease in a group of 14,604 subjects thoroughly examined for dental defects. Because Vincent's

infection, as a rule, though not always, starts as a form of gingival inflammation, the children who showed gum disorders were grouped separately and smears for bacteriologic examination were secured.

While the primary object of this study was to ascertain the value of the bacteriologic smear in the diagnosis of Vincent's infection, it has also served to point out the incidence of gingivitis in the grand total investigated. The data accumulated corroborate findings I previously reported on that subject[12].

The methods used in the classification of gingivitis and in the diagnosis of Vincent's infection have been previously described. No index or formula was used in estimating the incidence of this disease. It was felt that the employment of such procedure would leave the doors open for assumptions and incorrect conclusions.

The incidence of positive smears was higher in the white girls than in the white boys and lower in the Negro girls than in the Negro boys. The Negro children (male and female) showed a substantially higher incidence of positive smears than did the white children (boys and girls). This suggests that race plays an important part in susceptibility to this infection and that Negroes have a lower tissue resistance to it than do white children.

The relationship of age and sex to the incidence of positive smears was difficult to determine. There were inconsistencies in all the groups under consideration. The hypothesis that girls are more resistant to Vincent's infection because of their inclination to better habits of oral hygiene was only partly substantiated. Social status seemed to play no definite part in susceptibility. Resistance to the infection as well as susceptibility to it was not indicated by any consistent upward or downward trend regardless of socio-economic levels.

Some authors[13] claim that fusiform bacilli and the spirochetes of Vincent occur widely, if not generally, in every mouth. According to a recent account these bacteria may be found "in any mouth"[14]. It is also stressed that these microorganisms inhabit the oral cavity as "normal" flora of the mouth[15, 16]. That they are normally present in virtually every healthy mouth is another often repeated and accepted conclusion[17]. My studies of children with healthy mouths fail to corroborate such claims. The term "healthy" as employed in this study denotes mouths with clean teeth, no active caries, and no calculus. The gingivae were pink, with normal crests, no zones of inflammation, and no pockets. The mucous membrane of the mouth was normal; the tongue clean; the pillars of the fauces and the tonsils were not hypertrophied. There was no fetor oris. Correct habits of oral hygiene seemed to be the rule.

A careful study of Table XII makes it possible to discover that the microorganisms found in Vincent's infection are not normally present in practically every healthy mouth. No statement could be further from the actual situation.

It will be noted from a further study of this table that more smears secured from white girls than from white boys were positive for Vincent's infection. The number of Negro boys with positive smears was greater than that of the Negro girls. The greater susceptibility of Negro children to this disease was again demonstrated.

The children with apparently healthy mouths showed no clinical evidence of Vincent's infection. Yet in 9.7 per cent fusospirochetal organisms were present (Table XII). This finding might be held to support the view that these bacteria regularly exist in healthy mouths, but it disclosed no such evidence. Don Chalmers Lyons[18], Appleton[19], and others consider

TABLE XII

Vincent's infection in apparently healthy mouths. Incidence of positive smears in 906 white and Negro children. Three hundred and thirty two of these children were not included in the group of 2210 subjects forming the main substance of this study

	White Boys	White Girls	Negro Boys	Negro Girls	Total
Number of children with apparently healthy mouths	268	247	194	197	906
Number of smears taken in them	268	247	194	197	906
Number with positive smears	16	18	30	24	88
Number with negative smears	252	229	164	173	818
Per cent with positive smears	5.8%	7.2%	15%	12%	9.7%

such individuals to be "carriers". I maintain that the mouths of "carriers" are not healthy mouths. The presence of these germs (regardless of whether or not the designation "carriers" be accepted) is probably due either to contagion or to one or more of the predisposing factors mentioned earlier which played a part in the original invasion.

While the subject of treatment does not come within the scope of this study, mention should be made in passing that 86 of the 88 children with apparently healthy mouths, and nearly all of the children with very slight gingivitis who were also found positive for Vincent's infection were treated by me. Cures based on bacteriological findings were more difficult to obtain in most of these cases than in many with marked clinical manifestations which also were positive for the disease. In the latter, healing of the gingivae was simultaneous with the disappearance of the fusospirochetal organisms as verified by their absence in microscopical smears. This tends to indicate that these particular bacteria are the primary factors causing the disease regardless of the presence or absence of lesions, or of the degree of severity of the lesions when present.

Most of the children with moderate gingivitis and all with severe gingivitis showed clinical characteristics of Vincent's infection. Table XIII gives the results of the actual findings in this group. The point of greatest interest is that nearly 86 per cent in this division were free from fusospirochetal organisms. This, however, is not the whole story, for these findings mean that the clinical features are not reliable diagnostic criteria. Furthermore, they mean that these microorganisms are not normal inhabitants of the mouth. Finally, they signify that the Borrelia vincenti and fusiform bacilli are *not* found in practically every mouth.

As to the children with very slight and slight gingivitis, it is worth noting that less than 10 per cent were positive for Vincent's infection. The important fact in these findings is that fusospirochetal organisms do not as a matter of course inhabit the mouth. Further study of this table discloses that now and again (as in the case of the children with moderate and severe gingivitis) the Negro subjects (male and female) evinced a definitely higher incidence of the disease. I have not yet discovered the precise reason for this. Environment, poor oral hygiene, lack of attention to dental needs, and fatigue induced by working after school hours were considered possible predisposing influences in many of the older subjects. While information was furnished supporting some of these views, no definite conclusions could be drawn in their cases or in the cases of younger children with

TABLE XIII

Gingivitis and Vincent's infection: incidence of positive smears in the white and Negro boys and girls studied (ages 5 to 16 years inclusive)

	White	Negro	Total
Number of children with gingivitis	1110	382	1492
Number of children with slight and very slight gingivitis	705	238	943
Number with positive smears	41	47	88
Per cent with positive smears	5.8%	19.7%	9.3%
Number of children with moderate and severe gingivitis	405	144	549
Number with positive smears	39	40	79
Per cent with positive smears	9.6%	27%	14.38%

good oral hygiene, no evidence of fatigability and with apparently healthy mouths. The fact that Negro children (male and female) are less susceptible to gingivitis than white children (Table I) is of paramount importance if we note that their susceptibility to Vincent's infection is considerably higher. The connection between gingival status and this disease again becomes less obvious. But it can hardly be denied that the resistance of Negroes to this infection is less than that of white children.

No relationship could be established between caries and gingivitis or between caries and Vincent's infection. While certain systemic diseases may be predisposing factors in its initiation, respiratory diseases such as asthma and tuberculosis or a susceptibility to tuberculosis must be ruled out. It seems likely that, in general, correct oral hygiene minimizes the possibility of acquiring this affection.

Children of low intelligence as well as "problem" children seem to face a greater chance of getting this infection. Lack of interest in matters pertaining to health is conducive to poor oral hygiene and its sequelae.

Conclusions

The statement that the microorganisms found in Vincent's infection are present in practically every mouth is erroneous.

The clinical features of the disease are inconsistent and so do not furnish a criterion for correct diagnosis. Gums showing clinical characteristics of Vincent's infection may be affected with any one of several gingival disorders. Differential diagnosis is impossible without a bacteriological examination. Plaut[1] depended on microscopic exploration ("mikroscopische Exploration") to diagnose his cases, and Vincent[2, 3, 4] employed microscopic examinations ("examinées au microscope") in all of his patients. This is mentioned here for what it is worth. It cannot be ignored.

Gingivae in the exudate of which fusospirochetal organisms have been demonstrated by microscopic examination are gingivae affected with Vincent's infection, regardless of their clinical appearance. There is no other positive proof of the presence of this disease. Diagnosis and cure based on visual examination and objective signs and symptoms are all too often unfortunate examples of unverified deductions.

This study has also served to point out the incidence of gingivitis in the grand total of 14,604 children examined. One thousand four hundred ninety-two (10 per cent) of those investigated showed the presence of this disease. An analytical study of the findings will reveal that Negro children are less susceptible to gingivitis than white children. The number affected in each group is given in Table I.

TABLE XIV

General summary: incidence of Vincent's infection in the white and Negro boys and girls studied (all ages combined)

	White Boys	White Girls	Negro Boys	Negro Girls	Total
Number of children studied	906	751	450	435	2542
Number of smears taken	925	775	450	435	2585
Number with positive smears	62	67	95	76	300
Number with negative smears	863	708	355	359	2285
Per cent with positive smears	6.7%	8.6%	21%	17.4%	11.6%

Table I further shows that 807 children had slight gingivitis, and 332 severe gingivitis. Two hundred and seventeen suffered from moderate gingivitis, and 136 from a very slight gingivitis. As previously noted, 90 per cent of the children were free from any form of the disease. The figures in Table I also show a lower incidence of gingivitis in female children. The relationship of age to gingivitis appeared inconclusive in this investigation. The possibility suggests itself, however, that at the age of puberty endocrine factors may exert a certain influence in the development of the disease. For example, the children in the 12- and 13- year age groups, showed the highest incidence of gingivitis (Tables V, VI). Special studies along this line are needed.

Social status seemed to play no part in gingivitis susceptibility (Table XI). Intimations of a strong possible relationship of race to both gingivitis and Vincent's infection were noted. It must be submitted, however, that there is something special or characteristic in the manner the two races studied are affected by each of these diseases. The figures given in Tables I and XIV show exactly their interesting and opposite effects in the groups investigated.

It is important to reiterate that the present investigation proves conclusively that appropriate bacteriological tests are necessary for the positive diagnosis of Vincent's infection.

I wish to express my appreciation to Mrs. Ellen M. Hallahan for statistical assistance in this study.

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Abstracts

LAW, S. E., JOHNSON, C. E., AND NOTSUN, J. W. *Studies on Dental Caries Service for School Children.* Public Health Reports, **70:** 402–9, April, 1955.

This article represents the last report of a series of three studies in Woonsocket, Rhode Island that were designed to evaluate the dental service needs of school children. Over eighty percent of the total enrollment in the Woonsocket schools, averaging approximately 5100 children, received complete dental care in each of the four treatment series. Six percent of the children were cared for regularly by their own dentist and about ten percent received no care from any source. Approximately two years were necessary to complete each of the four series. The initial examination showed an average of 6.39 carious teeth, 1.32 filled, and 0.99 missing teeth per child for all age groups, 5 to 16 years. During the fourth treatment series, the corresponding rates were 2.28, 5.63 and 0.33 teeth per child. This is probably the most striking aspect of the study, because it supplies factual evidence to the supposition that good dental care will reduce dental defects and loss of teeth through caries.

The dental manpower needs for the completion of treatment decreased at each treatment series. Each dentist cared for 384 children a year in the first series; he was able, however, to extend his services to 848 patients by the fourth series time.

A very comprehensive study has been made of the dental needs of children and the manpower necessary to afford adequate dental care. Since all treatment was completed on these children, it forms an excellent basis for the evaluation of dental public health needs in an average community.

PROWLER, J. R. AND SMITH, E. W. *Dental Bone Changes Occurring in Sickle-cell Diseases and Abnormal Hemoglobin Traits.* Radiology, **65:** 762–9, Nov. 1955

A dental radiographic study is reported of 55 individuals, 35 of whom had the various genetic forms of sicklemia, 4 with hemoglobin C trait and 16 with no demonstrable hemoglobin abnormality. These patients were divided into 2 groups: the first group included 45 persons with a previously established diagnosis, the second group of 10 individuals was not previously suspected of having any hematologic disorder and was selected from a group of 100 dental radiographs solely on the basis of sickle-cell changes in the bone pattern that were evident upon their dental radiographs. Of these individuals, one was found to have sickle-cell anemia, one had sickle-cell hemoglobin C disease, two had hemoglobin C trait, two had no abnormality and one was not available for study.

The radiographic changes ranged from complete absence of trabiculae in the mandible and maxilla, except along the alveolar crest, to minimal changes which showed only one or two large radiolucencies in the mandible which could not be explained on a dental basis. Certain radiopacities of non-dental origin appear in the more severe forms of sicklemia and are thought to be of similar origin to the healed bone infarcts seen in the long bones of these patients.

Radiographic changes in the dental bones were demonstrable in every instance of sickle cell disease. A relationship between the severity of the dental bone changes and the clinical severity of the disease is suggested by the findings of this study.

It would seem from the results of this

study that dental radiographs may be of considerable value in detecting individuals with hemoglobin abnormalities.

LARON, ZVI, CAVLAS, B. D. AND CRAWFORD, J. D. *The Action of Cortisone on the Teeth of Rachitic Rats.* Arch. Pathology **61:** 177–180, Feb. 1956.

Administration of cortisone to humans sometimes induces osteoporosis and may retard skeletal growth and maturation. This study reports the effect of cortisone on the developing dentin of rachitic rats and is a part of a study of the antagonism between vitamin D and cortisone.

Rats were made rachitic by feeding a low calcium and vitamin D free diet for 17 days. Various combinations of Calcium, vitamin D and Cortisone were given and the effects noted.

There was no significant change in organic phosphorus, in any combination of therapies. However, serum calcium was significantly increased whenever cortisone was used. Serum alkaline phosphatase was increased, but to a lesser degree by cortisone. There was no interference with dentin matrix formation, but when calcium, vitamin D and cortisone were used the band of predentin was wider and less calcification was noted than when calcium and vitamin D were used without cortisone.

Cortisone clearly retarded calcium deposition in developing dentin at the 5 mg per day dose level.

A blocking of the action of either vitamin D or cortisone when used together was not observed. Therefore, the increase in serum calcium and alkaline phosphatase and interference with dentin maturation that was observed must be due to an antagonistic action at different locations rather than an intermolecular destructive reaction between the two steroids.

VAN DU WAST, W. A. M. *Speculations Regarding the Nature of Gingival Hyperplasia Due to Diphenylhyantoin Sodium.* Acta Med. Scand. **153:** 399–405, Jan. 1956.

Dilantin has been proven to be a very useful drug to control epilepsy. However, about 40% of patients treated with dilantin develop a hyperplastic gingivitis if teeth are present in their mouths. Gingival hyperplasia is not a factor in edentulous patients. In this investigation, 23 patients treated with dilantin and exhibiting gingival hyperplasia were used. Biopsies were done of the hyperplastic tissue and bone marrow. Morphological blood examinations were completed on all of the patients.

Histologically, both the epithelium and submucosa were markedly hyperplastic with a dense infiltration of mono-nuclear cells most of which seemed to be plasma cells. Plasma cells are said to produce antibodies and an increase of the blood gamma globulin level was noted in 20 of the 23 patients used for the investigation. The bone marrow biopsies and morphologic blood studies were within normal limits.

Side effects of drugs may be toxic or allergic. It is felt that the gingival hyperplasia reaction to dilantin is on an allergy basis, because of the plasma cell infiltration, increase of gamma globulin of the blood, the fact that the drug group to which dilantin belongs possesses great sensitizing capacity and the other side effects noted, dermatitis, purpura, agranulocytosis and eosinophilia, are considered to be due to sensitization.

Further studies are planned to determine the exact mechanism of the hyperplastic response to the drug by the gingiva.

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